PSYCHE

A JOURNAL OF ENTOMOLOGY

ESTABLISHED IN 1874

VOL. XLII MARCH, 1935 No. 1

CAMBRIDGE ENTOMOLOGICAL CLUB
1874

TABLE OF CONTENTS

Preliminary Note on the Structure of the Pretarsus and Its Possible Phylogenetic Significance. *R. T. Holway* 1

The Biology and Morphology of the Immature Stages of *Macrocera anglica* Edwards. *S. Madwar* 25

Two New Ants Collected in Quarantine. *W. M. Mann* 35

New Ants from the Philippines. *W. M. Wheeler* 38

A Few New North American Neuroptera. *N. Banks* 53

Varietal Forms of Peripatus in Haiti. *C. T. Brues* 58

A New Hesperid from Haiti (Lepidoptera; Rhopalocera). *E. L. Bell* 63

Myrmecological Notes. *W. M. Wheeler* 68

CAMBRIDGE ENTOMOLOGICAL CLUB

OFFICERS FOR 1934

President	P. J. Darlington, Jr.
Vice-President	O. E. Plath
Secretary	D. Davenport
Treasurer	F. H. Walker
Executive Committee	Jos. Bequaert F. M. Carpenter W. M. Wheeler

EDITORIAL BOARD OF PSYCHE

EDITOR-IN-CHIEF

C. T. Brues, Harvard University

ASSOCIATE EDITOR

F. M. Carpenter

CONSULTING EDITORS

Nathan Banks,
Harvard University.

Thomas Barbour,
Harvard University.

A. E. Emerson,
University of Chicago.

A. L. Melander,
College of the
City of New York.

A. P. Morse,
Peabody Museum,
Salem, Mass.

J. G. Needham,
Cornell University.

W. M. Wheeler,
Harvard University.

PSYCHE is published quarterly, the issues appearing in March, June, September, and December. Subscription price, per year, payable in advance: $2.00 to Subscribers in the United States; foreign postage, 25 cents extra, Canada 15 cents. Single copies, 65 cents.

Cheques and remittances should be addressed to Treasurer, Cambridge Entomological Club, Institute of Biology, Harvard University, Cambridge, Mass.

Orders for back volumes, missing numbers, notices of change of address, etc., should be sent to F. M. Carpenter, Museum of Comparative Zoology, Cambridge, Mass.

IMPORTANT NOTICE TO CONTRIBUTORS

Manuscripts intended for publication, books intended for review, and other editorial matter, should be addressed to Professor C. T. Brues, Institute of Biology, Harvard University, Cambridge, Mass.

Authors contributing articles over 8 printed pages in length will be required to bear a part of the extra expense, for additional pages. This expense will be that of typesetting only, which is about $2.00 per page. The actual cost of preparing cuts for all illustrations must be borne by contributors; the expense for full page plates from line drawings is approximately $5.00 each, and for full page half-tones, $7.50 each; smaller sizes in proportion.

AUTHOR'S SEPARATES

Reprints of articles may be secured by authors, if they are ordered before, or at the time proofs are received for corrections. The cost of these will be furnished by the Editor on application.

Entered as second-class mail matter at the Post Office at Boston, Mass. Acceptance for mailing at special rate of postage provided in Section 1103, Act of October 3, 1917, authorized on June 29, 1918.

Printed by the Eliot Press Inc., Jamaica Plain, Mass., U. S. A.

PSYCHE

A Journal of Entomology

Volume XLII

1935

Edited by Charles T. Brues

Published by the Cambridge Entomological Club
Biological Laboratories
Harvard University
Cambridge, Mass., U.S.A.

PSYCHE

VOL. XLII MARCH 1935 No. 1

PRELIMINARY NOTE ON THE STRUCTURE OF THE PRETARSUS AND ITS POSSIBLE PHYLOGENETIC SIGNIFICANCE

By Richard T. Holway

Biological Laboratories, Harvard University

The uncertain reliability of morphological structures for determining ancestral relations is well known and the extreme care and attention to the vagaries of parallelism, specialization, etc. so necessary for the development of valid theories have been rightly emphasized of recent years. However, in spite of its late disrepute, there is yet much to be learned from comparative morphology if sufficiently long series are studied and checked with the trends of parallel structures and if a most judicious interpretation of the evidence is demanded.

The primary purpose of this paper is to indicate the type of claw-segment found in the important insectan orders together with the common basic plan occurring throughout and also to outline possible homologies which further study and examination of selected and thoroughly representative series from each order may support. Although it is impossible at the present stage to offer any evidence substantial enough to warrant forming exact conclusions as to homologies from order to order, to say nothing of attempting to solve phylogenetic problems, there are without doubt most significant agreements in many cases which provide definite possibilities to be tested by further study. Especially important are those correlations which fall in with phylogenetic concepts already accepted (or debated) from the evidence of the comparative morphology of other structures.

For example, the concurrence of Trichoptera and Lepidoptera is not questioned and some investigators have suggested that these two groups might even be conceived of as one valid order. The nature of the claw-segment of Astenophylax (Fig. 21) and Automeris (Fig. 22) shows at a glance the proximity of these structures even in such advanced representatives of the respective orders.

The relative value of a structure like the pretarsus as a phylogenetic guide may be uncertain, but the above example indicates that such consistency of the claw-segment from order to order should make it of considerable utility in checking theoretical relationships. Although the basic plan of the pretarsus presents a certain conformity throughout the orders, there are sclerites which are variable enough to warrant their investigation from the standpoint of taxonomy. For example, within the Hymenoptera the orbicula may be important in this respect. Hayes and Kearns (1934) have studied the empodium of Coleoptera and find that the Adephaga is the only group showing any consistancy in structure; they conclude, in general, that there is in some a tendency towards generic or family uniformity but that the super-families are decidedly heterogeneous. Arolia and pseudarolia have long been used as the basis of classification for the Miridae and for other Hemiptera the empodium may prove to be of taxonomic value.

Acknowledgements

The writer is indebted to Professor C. T. Brues and Professor G. C. Crampton for their advice during the preparation of this paper, and to them and to the Museum of Comparative Zoology for much of the material herein figured.

Terminology.

The general structure of the pretarsus has been figured many times for different orders: Snodgrass gives detailed descriptions of the condition in the honey-bee (1925) and figures several other types (1927); Crampton (1923) compares the claw-segment of Periplaneta with those of Leptid and Asilid Diptera; Hayes and Kearns (1934) have studied the pretarsus of Coleoptera and summarize past work on this structure; de Meijere's investigations are more extensive and cover all the important orders but his German terminology is not used at all in this country. A complete history of the terminology of the numerous parts of the claw-segment must be left for a later and more comprehensive study of this structure, therefore that system accepted by the more recent investigators is followed throughout. In some cases the same terms are used from order to order, even though true homology is not yet proved, instead of offering new names which in all probability would have to be discarded after further study supplied evidence to substantiate suspected homologies. However, all doubtful cases are indicated as such.

The following is a list of the terms herein used with their definitions and equivalents.

Apodeme (Unguitractor tendon, Sehne).—This is the tendon which runs from the unguitractor plate to the tibial musculature, the flexor of the claws. Supposedly the claws spring back into their normal position by natural resiliency when tension through the apodeme is released as there is no levator of the pretarsus in insects. (Crampton 1923) (Snodgrass 1929).

Arolium. In general the term arolium is restricted to a median paired or unpaired, pad-like structure which is articulated to the unguifer or arises from a position midway between the claws. Whether the complicated median structure of Hymenoptera, Lepidoptera and Trichoptera, the paired ribbon-like parts known as arolia in certain Hemiptera (Miridae), and the single median pad of Diptera and orthopteroid insects are all strictly homologous is problematical. However, the term arolium is here used to designate these structures in every order in which they occur, according to the definition above.

Basipulvilli. (auxilliæ). This term was first applied by Crampton (1923) to the small lateral sclerites at the bases of the pulvilli of Diptera and also to similar sclerites laterad of the unguitractor in Periplaneta although true pulvilli are not found in Orthopteroids. The auxilliæ (Hymenoptera), of MacGillivray, are evidently homologous with these structures but wherever such parts are found they are called basipulvilli in this paper.

Camera. (Bugel, or bow of Arnhart). Camera was originally applied to the curved narrow sclerite supporting the paired lobes of the arolium in Hymenoptera (MacGillivray). It is herein also used to designate the evident homologue in Trichoptera, Lepidoptera and Mecoptera.

Distitarsus. (onychium, digitus, ungula, etc.). The distal tarsal segment.

Empodium. (onychium). This term has been used for a variety of structures. Crampton (1923) finds that it should be restricted to a process of the unguitractor as found in Asilid Diptera and other orders. Hayes and Kearns (1934) accept this view and apply the term in their work on Coleoptera. Empodium is often used erroneously to refer to a pulvillus.

Flexor membranes. These are the membranous areas beneath the claws which apparently serve to transfer the tension of the apodeme on the unguitractor to the claws thus forcing them downwards. They are the areas from which, it has been suggested, the puvilli may have developed.

Gleitrinne or Gleitfläche (de Meijere). A prolongation of the ventral wall of the distitarsus. It is especially developed in Odonata and in some Coleoptera where it extends forward between the claws.

Onychium. This term has been used in such a variety of ways that it appears impossible to define it satisfactorily and therefore is not used in this paper.

Orbicula. In Hymenoptera, a small dorsal sclerite at the base of the arolium and distad of the unguifer. The orbicula is quite variable as to size and shape in this order and may be of taxonomic value.

Parempodia. (paronychia). Bristle-like appendages of the empodium. (Coleoptera and Hemiptera).

Planta. As used by Snodgrass, Crampton and MacGillivray planta applies only to the sole of the foot (typically in Hymenoptera and Orthoptera). However, the examples of most of the various orders observed show a plate which is probably homologous with the hymenopterous planta and therefore this term is used wherever practicable. Coleoptera, Diptera, Hemiptera, Dermaptera, Odonata and Ephemeroptera do not exhibit the planta in its typical condition although an empodium is present in these orders (except Ephemeroptera) which suggests the possibility that the empodium is merely a modified planta, closely associated with the unguitractor. Further study is needed to determine the correct relationships of these structures.

Snodgrass (1929) suggests that the planta may possibly be a subdivision of the unguitractor. However, the nature of the planta under high magnification is unlike that of the unguitractor which always gives a granulose appearance, is heavily sclerotized, and is sharply demarked in every case observed even to the primitive Odonata and Ephemeroptera. On the other hand the planta is variable in extent and degree of sclerotization and never shows the heavy, rugose aspect of the unguitractor. It seems more likely that the planta represents merely an area of the membranes distad of the unguitractor which has become sclerotized in greater or less degree according to the stress to which it is subjected by the tension of the apodeme and unguitractor. Of course the unguitractor itself is a sclerotized area of the membrane but it is always distinct in outline and not an indefinite structure as the planta often appears to be. (Note.—Planta has also been used to refer to the basal joint of the post tarsus in pollen-gathering Hymenoptera, to the soles of the post tarsal joints and to the anal clasping legs of caterpillars).

Pseudarolia.—Paired structure which occurs beneath the claws of some Hemiptera (Miridae) and which possibly will prove to bear some relation to pulvilli.

Pulvillus.—Originally referred to the pad-like structure beneath each claw in many Diptera. Other orders in which undoubted homologous parts occur are Lepidoptera and Trichoptera. Membranous areas are found beneath the claws in most orders but it is impossible to consider them as homologous with the pulvilli. In this paper they are termed flexor membranes. Crampton (1923) suggests two possible derivations for the pulvilli: either they arose as portions of a divided arolium (see condition in Hymenoptera, Fig. 26, Plecoptera, Fig. 7, and Mantispa, Fig. 19.) or they are detached membranous areas from the under side of the claws (see condition in some Ephemeroptera, Fig. 2, Homoptera and Hemiptera, Figs. 14 and 15, and the relation of basipulvilli to such membranous areas in Blattids.)

Ungues.—The claws.

Unguifer.—(tubercula, and Gelenkhöcker of de Meijere) refers to a small dorsal sclerite by which the claws are articulated with the distitarsus.

Unguitractor—(tarsulus, calcanea). This sclerite is the most constant structure of the pretarsus and is easily identified in all insects thus far observed because its general appearance is always the same though varying in size and shape. The surface of the unguitractor is sculptured to a greater or less degree with nodules which are sometimes almost spinelike. These nodules appear to correspond with the polygonal cells of the hypodermis and these cells may be seen through the chitin with high magnification. Snodgrass (1927) shows that in Tibicen this plate may be divided into two sclerites and also he figures in the membrane distal to the unguitractor, two small plates which he says may represent the arolium. It seems more likely that they are a divided planta but there is little evidence as yet for either supposition.

Discussion.

ORDER ODONATA

Anax junius Drury. (Fig. 1)

The claw-segment of *Anax* is simple and consists of the unguitractor plate (ut) with the expanded distal portion which is probably an empodium (em?) and of the lateral fleshy pads, flexor membranes (fm.),—which transmit tension to the ventral surfaces of the claws. The Gleitfläche of de Meijere, or thickened ventral portion of the distitarsus over which the unguitractor slides, is well developed in Odonata and a process of this structure extends beyond the bases of the ungues (un). The only other orders in which this condition has been observed are Coleoptera and Hemiptera.

ORDER EPHEMEROPTERA

Siphlonurus sp. (Fig. 2)

The unguitractor is a small pear-shaped plate and the claws (un) are simple. The important feature in this case is the membranous pad-like structure (pv?) closely applied to the ventral surface of each of the ungues. It is this condition which has led Crampton to suggest that possibly the pulvilli (Diptera) were derived from some such situation, that is, a splitting off of a ventral membrane from the claw itself. Proximally these pad-like structures are closely associated with the membranous areas transmitting tension from the unguitractor to the claws and in fact give evidence of being continuous with them.

Although these examples of Odonata and Ephemeroptera both show their elementary position, (absence of arolium, planta, basipulvilli or other significant structures), they give no evidence of any close relationship for the presence of an empodium in Anax indicates a certain amount of specialization. Thus, if these cases prove to be typical, the conclusions to be derived from the comparative morphology of the pretarsus will evidently be in agreement with the general conception of the relative positions of these orders.

CURSORIAL ORTHOPTERA

Blattidae—Periplanta americana L. (Fig. 3)

The arolium (ar) is large in this family, although its structure is simple compared with the complicated types found in the higher orders. Ventrally it is membraneous and concave, so that it forms a most efficient adhering organ. The unguitractor is typically large and heavily sclerotized. Two other structures of importance appear in this group. The planta (pl) is a median quadrate plate just distal to the unguitractor and seems to be lightly sclerotized; it bears a single large seta. On either side of the planta is a small sclerite, the basipulvillus (bp) of Crampton, from which the retractile membrane leads to the under side of the claw. The relation of these membranes to the basipulvilli (where they are present) is the same throughout the orders and with further study should present interesting evidence with respect to the hypothesis that the pulvilli are evolved from such membranes.

Mantidae—Tenodera sinensis Saussure. (Fig. 4)

An arolium has not been found in Mantids thus far observed and such a structure is probably absent in this family. The general plan follows closely that of the roach although a seta is not present on the planta. The flexor membranes are large and especially noteworthy are their lateral expansions which if further produced might easily take on the appearance of pulvilli!

ORDER ISOPTERA

Termopsis angusticollis Walker (Fig. 5)

Again, in this case the basic plan follows closely that of the Blattid; however, the planta is much smaller than in either Mantid or Blattid and the seta does not arise from the planta itself but from the membrane. This condition might be taken as evidence for the view that the planta is a variable sclerotized area of the membrane between the claws. Although there is no arolium we find between the bases of the claws in winged termites a small plate (ar?) which undoubtedly represents an abortive arolium for in winged specimens of Mastotermes, a definite arolium, even though small and rudimentary, is present. Unguitractor and basipulvilli, as in the Mantid, show no significant variations from the Blattid type.

The proximity of these three groups has been noted many times by students of insect morphology so that such a correlation in type of pretarsus is not surprising. This combination appears even more natural when contrasted with the equally coherent union (from the standpoint of Pretarsus) of the Saltatorial Orthoptera.

ORDER EMBIOPTERA

Oligotoma sp. (Fig 6)

In this order we again find the Blattid type; the planta is more extended laterally and is in contact with the basipulvilli on either side. There is no arolium and the flexor membranes are large and slightly expanded. There seems to be nothing particularly outstanding about the claw-segment of this insect but in general it approaches that of the Plecopteran to such a degree as would not prohibit the conception that these two orders are related.

ORDER PLECOPTERA

Pteronarcys dorsata Say (Fig. 7)

Pteronarcys shows the lateral basipulvilli and median planta as found in cursorial Orthoptera and termites. The arolium is a large and complicated structure which is made up of three lobes: a median portion or true arolium, and two lateral smaller pads beneath the claws which may be secondary divisions of the arolium or pulvilli which have become fused with the arolium. A more complete study of the Plecoptera may settle this question if intermediate forms can be found. On the other hand, it is possible that this structure represents a new development with no traceable homologies to the parts referred to above. (This also applies to similar lobes beneath the claws of many Homoptera and Hemiptera, to be discussed later). Dorsally, the membranous pads are supported by chitinous plates (indicated by broken lines) and the median lobe bears two clusters of small setæ on its ventral surface. The presence of planta and basipulvilli make it unlikely that the Plecoptera should be considered with the Archipterygota.

SALTATORIAL ORTHOPTERA

Locustidae—Melanoplus bivittatus Say (Fig. 8)

A large arolium has been found in all Locustids observed as contrasted to Tettigoniids and Gryllids in which this structure probably does not occur. It should be noted that the presence or absence of an arolium is not a condition which is constant for an order, but further study should produce information concerning its consistency in groups below ordinal rank. The absence of basipulvilli is characteristic of all the leaping Orthoptera and it is this factor which gives such a clear-cut division between the two orthopteroid groups. The planta of Melanoplus is more heavily sclerotized than the representatives of Tettigoniidae and Gryllidae which were examined.

Tettigoniidae—Ceuthophilus maculatus Say (Fig. 9)

Except for the absence of arolium and basipulvilli, the condition of the planta seems to be the only important feature of Ceuthophilus. This structure is not as heavily sclerotized as it is in Melanoplus and is quite different in shape. Often the planta is so lightly demarked, especially in small insects, that its boundaries are almost indistinguishable from the surrounding membrane.

Gryllidae—Gryllus pennsylvanicus Burm. (Fig. 10)

Gryllus gives us the first radical variation in the unguitractor for here the form is quite different from anything else found among the Orthoptera. This sclerite is characterized by a longitudinal V-shaped ridge or protuberance, the significance of which must remain in doubt until series are studied in groups below the order. It is possible that the less notable variations (chiefly in outline) of the unguitractor observed in these orthopteroid families will prove to be consistent to some degree. The planta may be easily compared with that of Ceuthophilus and differs mainly in the length of the lateral arms and the nature of the posterior margin.

Gryllotalpidae—Gryllotalpa borealis Burm. (Fig. 11)

Considerable modification of the planta is exhibited by Gryllotalpa and its condition in this insect is one of the factors suggesting a close relationship between planta and empodium. Note the numerous large setae and the manner in which the anterior portion of the unguitractor merges with the flexor membranes and planta. Comparison of the latter with the corresponding structure in Ceuthophilus and Gryllus indicates that it is a planta.

Empodium by definition refers to a process of the unguitractor, but this term must also apply to certain structures closely associated with the unguitractor which are not actual processes of it. Eg., the setiform empodium of Asilid Diptera is articulated with the unguitractor rather than continuous with it; also the coleopterous empodium in many cases gives some evidence that it may be retracted within (or beneath?) the unguitractor as pointed out by Hayes and Kearns. At any rate the empodium is not necessarily a distinct part of the unguitractor, so that the condition in Gryllotalpa may be intermediate between the typical isolated planta (as of Melanoplus) and the empodium of many Coleoptera where there is no discernable break between this structure and the unguitractor. Ceuthophilus and Gryllus may represent a step beyond the Melanoplus type towards closer association of planta with unguitractor.

About all that can be definitely said for the Saltatorial Orthoptera (sensu strictu) at the present time is that they are linked by a universal absence of basipulvilli and by the nature of other more variable features such as planta and flexor membranes. In any case there appears to be a wealth of material to be investigated within this group.

Phasmidae—Anisomorpha buprestoides (Stoll) (Fig. 12)

The absence of basipulvilli would place the Phasmids with Saltatorial rather than Cursorial Orthoptera and this is in agreement with conclusions presented by students of other structures. The unguitractor is narrower than in other Orthopteroids, while the planta is more heavily sclerotized and is triangular in outline, but is distinct from the unguitractor, a condition nearer to that of Locustids than to the other Saltatorial Orthoptera. The arolium is large and is reinforced dorsally by thickened ridges. On the whole the condition of the claw segment of this insect may be considered as supporting the general conception of the position of this family, *i. e.*, related to the Saltatorial Orthoptera but developed along its own line of specialization.

ORDER DERMAPTERA

Psalis sp. (Fig. 13)

Apparently basipulvilli and planta are missing in Psalis. If this proves to be true for all Dermaptera, the order will be set off from the Blattid group on the one hand, and the remainder of the orthopteroid insects on the other. (Speaking from the standpoint of pretarsus only, of course). The unguitractor of Psalis is interesting because of its anterior projection (em?) which could be considered either empodium or planta; superficially, this structure appears to be continuous with the unguitractor and therefore more like a coleopterous empodium except that its margins are vague and it is not heavily sclerotized, *i. e.*, more like a planta. It should be noted and may prove to be significant that all examples of Coleoptera thus far observed show neither basipulvilli nor planta but do have an empodium, whereas all specimens of most higher orders studied are fundamentally of the Blattid type with numerous secondary specializations.

ORDER HOMOPTERA

Agallia constricta Van Duzee (Fig. 14)

The small unguitractor bears a triangular empodium (em) which in turn is provided with a single heavy seta or parempodium (pem). As there seems to be considerable variation in the number of setae and in the shape of the empodium among the Homoptera, this group must be more fully studied to determine the extent and constancy of such variations. Attached to the under surface of the claws and extending beyond their tips are large membranous pads (pv?) which are reinforced meso-dorsally by small sclerotized areas. There are no basipulvilli.

The pretarsi of Cicadidae are not of this type nor do they show any features characteristic of the more advanced Hemiptera. As figured by Snodgrass (1927) the unguitractor of *T. septendecim* is divided into two plates; there is no empodium, but two small setae-bearing sclerites occur in the membrane between the claws, and Snodgrass suggests that these may represent the arolium but there seems to be more reason to consider them as a divided planta. In *T. cinera* these plates are very faint and difficult to distinguish from the surrounding membrane. There are no pads beneath the claws.

ORDER HEMIPTERA

Brochymena arborea (Say) (Fig. 15)

The large triangular unguitractor is extended anteriorly to form a quadrate empodium which bears a parempodium on each of two lateral protuberances. Beneath the claws are pad-like structures (pv?) reinforced by chitinous plates but not attached to the claws beyond their bases in contrast to the condition in Membracidae, Cicadellidae, etc. Although it seems very probable that these pads will prove to be identical with those of the Homoptera, but separated from the claws, it is more questionable whether they can be considered as homologous to the pulvilli of higher orders especially because of the fact that typical basipulvilli do not appear in the Hemiptera-Homoptera. The condition in these groups, however, possibly indicates a way in which sub-ungual pads may be developed and split off from the claws. Further reduction of the membranes might result in the typical pseudarolia of the Mirids! It is hoped that an extensive study of the Hemiptera-Homoptera will illuminate the relations of these various structures.

ORDER COLEOPTERA

Phyllophaga fusca Froe. (Fig. 16)

As mentioned above, the empodium, rather than basipulvilli and planta, is the characteristic feature of Coleoptera. In this specimen the unguitractor is narrow and the empodium is expanded distally into a broad plate which bears two parempodia or large setae. Each claw is provided with a large median tooth.

Hayes and Kearns have figured many specimens from this order and although they find the empodium absent in many cases, there seems to be a typical fundamental plan for the coleopterous pretarsus. That is: First, a well developed unguitractor with or without some form of empodium which in turn may or may not bear parempodia; Second, total absence of any membranous structures which could represent arolia, pulvilli, etc. Hayes and Kearns find that "some cleared specimens show what appears to be a basal part of the empodium withdrawn into the body of the unguitractor." This condition is evidently the same as that here shown in *Phyllophaga fusca,* (Fig. 16) in which the broken lines indicate the basal part referred to. It is questionable whether this is really within the unguitractor; this portion of the empodium might be beneath the unguitractor, or, merely a degree of sclerotization.

There is considerable similarity between the claw-segments of Dermaptera and Coleoptera. Although the empodium of Coleoptera is of course much more varied than that of Dermaptera, these orders agree in the absence of other significant structures. Some of the figures from Hayes and Kearns in which the empodium is absent are strongly reminiscent of the condition in Psalis, as in the latter, the area distad of the unguitractor is rather indefinite so that it is not difficult to imagine the sclerotization of this area to form the kind of empodium characteristic of Coleoptera—or its total lack of sclerotization with a resulting absence of empodium which is also a condition commonly found in Coleoptera. This must remain pure speculation, however, until checked by further study.

ORDER NEUROPTERA

Sialidae—Corydalis cornuta L. (Fig. 17)

There is no arolium but the planta is large and the basipulvilli are contiguous with its lateral margins. The claws are simple and the unguitractor is triangular like that of Ithone. In general the pretarsus of Corydalis is surprisingly different from that of Mantispa, but except for the absence of arolium and basipulvilli setae, it is easily comparable to the claw-segment of Ithone.

Ithonidae—Ithone sp. (Fig. 18)

The arolium is a median pad somewhat like that of *P. americana,* but much smaller and without the ventral concavity of the latter. The relations of planta and basipulvilli are of the Blattid type, but the planta is very lightly sclerotized and is continuous with the arolium, so that it might almost be considered as a part of this structure. The basipulvilli occupy the normal position and are provided with three setae, incidentally, the only case observed where the basipulvilli bear setae. The unguitractor and claws are not distinctive.

The similarity of the claw-segment of Ithone with that of the Blattids is evident and perhaps significant, for this insect is considered to be the most primitive of the Plannipennia. Comparison of Figs. 17, 18 and 19 illustrates why Ithone may be considered as annectant between Corydalis and Mantispa.

Mantispidae—Mantispa brunnea Say (Fig. 19)

The pretarsus of Mantispa is provided with a complicated type of arolium which has probably developed from a simple pad such as found in Ithone. Two fleshy lobes are supported by lightly sclerotized areas, indicated by broken lines, and at the base, posteriorly, are two ovoid sclerites also serving as supports. There is evidently no planta, a condition consistent with the light sclerotization of the planta in Ithone. At present it is impossible to interpret the significance of these various parts in Mantispa but it is hoped that other specimens of Neuroptera will make it possible to find homologies with the structures of higher insects. The basipulvilli are large and extend laterally a short distance along the membranes. The claws are broad and pectinate; the unguitractor differs considerably in outline from that of Corydalis or Ithone and bears a median ridge. It will be noted that the claw-segment of Mantispa is not comparable to that of Corydalis in any of its features and, in fact, the divergency of these two types is greater than any variations found in other orders, a condition which emphasizes the fact that the Neuroptera are known to be a highly diversified group.

ORDER MECOPTERA

Panorpa rufescens Rambur (Fig. 20)

The unguitractor is oval and bears a conspicuous median ridge such as is found in Mantispa; the claws are pectinate. A rod-like planta extends between the bases of the claws and the basipulvilli. The arolium is simple and is supported by a curved structure (cm) which is probably the same as the camera of Hymenoptera.

ORDER TRICHOPTERA

Astenophylax argus Harris (Fig. 21)

The arolium is much like that of Panorpa and differs only in the curvature of the camera which is U-shaped in Astenophylax. The planta is also similar, that is, a narrow rod-like structure distad of the unguitractor. The basipulvilli are large and are located at the bases of the leathery pulvilli (pv) which are heavily fringed with long narrow scales. The claws are simple instead of pectinate and the median ridge is absent from the unguitractor,—two features in contrast to the condition in Panorpa.

ORDER LEPIDOPTERA

Automeris io Fab. (Fig. 22)

The claw-segment of Automeris is very similar to that of Astenophylax and varies only in the narrower, curved pulvilli and the nature of the arolium which gives evidence of developing a secondary lobe. The condition in many Lepidoptera where the arolium is lacking has not been investigated.

This agreement between Lepidoptera and Trichoptera was to be expected, although such a complete resemblance is perhaps surprising. There are also certain features traceable to Panorpa. (see Figs. 20 and 22). It is conceivable that some Mecopteran will be found with traces of pulvilli which appear to be common structures in the orders Lepidoptera, Trichoptera and Diptera. There can be no question but what the condition in Panorpa approaches that of the Trichoptera and Lepidoptera more closely than it does the Neuropteran types, except for the absence of pulvilli.

ORDER DIPTERA

Tabanidae—Tabanus atratus Fab. (Fig. 23)

The unguitractor is broadly triangular and the pulvilli and basipulvilli are typical. The arolium is articulated with the unguifer and on the ventral surface its membrane is continuous with that surrounding the basipulvilli and unguitractor. This is the structure erroneously referred to as pulvilliform empodium; it is really an arolium. (Crampton 1923). The arolium of Tabanus is simple and lacks the supporting sclerite, or camera. For this reason there may be some question as to its strict homology with the arolium of Mecoptera, etc. described above. The absence of a planta may be significant as a similar absence was noted in Mantispid Neuroptera. On the other hand, the arolium is like that of Ithone in nature *i. e.,* its ventral surface is continuous with the membrane distad of the unguitractor) and the planta of Ithone is so lightly sclerotized that it is conceivable that in many related forms the planta would be entirely absent.

Asilidae—Diogmites umbrinus Loew. (Fig. 24)

This insect has no arolium but is characterized by the presence of a setiform empodium, a long chitinous setiform structure arising from the distal margin of the unguitractor. The pulvilli are also long and narrow and similar to those of Trichoptera and Lepidoptera, but the basipulvilli are small.

A study of more primitive Diptera may bring out some annectant features which will be significant in regard to the origins of this order. Thus far there seems to be more common features in the Neuroptera than in the Mecoptera.

ORDER HYMENOPTERA

Siricidae—Tremex columba L. (Fig. 25)

The unguitractor is long and grooved and the basipulvilli are very small; pulvilli probably do not occur in the Hymenoptera. Tremex lacks an arolium which is a complicated structure when present in this order. The planta bears four setae and the claws are provided with a large median tooth or spur. The orbicula (rb) is a dorsal sclerite which is here shown only in part.

Sphecidae—Chalybion cæreuleum L. (Fig 26)

The arolium, here shown extended, is normally folded back against the planta when not in use. Except for the paired lobes this structure is much like that of Panorpa especially in reference to the camera. The planta is provided with many small setae and the unguitractor differs from that of Tremex in outline and absence of dorsal grooves. The claws are simple and the basipulvilli small. The orbicula, a small dorsal sclerite, is not shown in this view but this plate is variable throughout the Hymenoptera and together with the planta and unguitractor should prove valuable in studying the inter-relations within the order. As with the Diptera, it seems probable that further study of primitive types will be of phylogenetic value for the variety of structures does provide a wealth of material to work on.

Summary.

Without losing sight of the fact that only a few specimens selected at random from each order are studied, the evidence thus secured does seem to point out certain tentative hypotheses to be further investigated.

1. That the planta occurs in most of the insectan orders as a sclerotized area of the membrane just distal to the unguitractor and that this structure is homologous throughout by position, ie., its relation to the unguitractor, basipulvilli and claws. The presence of one or more setae may be a distinguishing feature; note the condition in cursorial Orthoptera and Hymenoptera. The degree of sclerotization is quite variable for in some cases the planta is almost entirely membranous while in others it forms a heavy plate.

2. That the empodium is a highly modified planta. No planta was found (in specimens so far observed) in the orders Diptera, Hemiptera, Coleoptera and Dermaptera but an empodium is present in at least some representatives of all these orders. On the other hand, wherever a planta occurs an empodium has not yet been observed. The condition of the planta in Gryllotalpa and Psalis, where it is closely associated with the unguitractor, illustrates how difficult an attempt to distinguish between these two structures may be. Comparison of Gryllotalpa with other Orthopteroids leaves but little doubt but what the part referred to is a planta even though numerous setæ are present, for such appendages also occur on the plantæ of cursorial Orthoptera and Hymenoptera. The occurrence of parempodia, which are really setae, on the empodia of Coleop-

tera and Hemiptera may also point to a close relation between these structures. These considerations, if supported by further investigation, indicate that the empodium is really a specialized planta, i. e., a planta which has become closely associated with the unguitractor and in some cases lengthened into a setiform process.

3. That the arolium or median pad-like structure occurring in many insects, although varying in complexity, is homologous throughout the orders. This structure is not of ordinal significance for it is present in some groups and absent from others within most orders.

4. That the small lateral sclerites (basipulvilli) are homologous in all orders; they form a support at the bases of the pulvilli when the latter are present and in such cases there is no question as to their homology. Many insects show these sclerites without the pulvilli but all other relationships are the same.

5. The problem of the origin of the pulvilli remains in doubt. Very possibly further study will support the suggestion of Crampton (1923) that they are membranous areas detached from beneath the claws. Thus far what evidence there is remains inconclusive, that is, briefly: the membranous claws of Ephemeroptera and the similar condition in certain Homoptera (Fig. 15); the pseudarolia of Miridæ which may be true pulvilli; the association of pulvilli and basipulvilli in Diptera, Trichoptera and Lepidoptera and the fact that the basipulvilli (if present) are always located at the bases of the flexor membranes in orders where typical pulvilli do not occur.

6. An interesting condition is that found in the orthopteroid insects. The similarity of certain anatomical features of the Blattidæ, Mantidæ and Isoptera is well known so that the agreement found in the claw-segments of these three groups is not surprising. The saltatorial Orthoptera, including the Phasmidæ, are also set apart as a coherent group by the nature of the pretarsus and the Dermaptera would seem to present a third Orthopteran type although less distinct and nearer to the Tettigoniids and Gryllids-plus coleopterous affinities.

7. That the planta and basipulvilli found in the Plecoptera would place this order with the Neopterygota rather than with such types as Odonata and Ephemeroptera in which parts as advanced as the above have not been found although the presence of an empodium in Odonata must be considered.

8. At this stage it is impossible to attempt any valid correlations between the types of pretarsi found in the higher orders other than such obvious relations as that of Trichoptera to Lepidoptera. However, it is evident that the variations of the several parts of the pretarsus found among the Holometabola, even in such a random selection of cases, warrant a thorough investigation of the condition in these orders with a view to possible clarification of the phylogenetic implications concerned.

LITERATURE CITED

Arnhart, L. (1923). Das Krallenglied der Honigbiene. Archiv f. Bienenkunde, 5:37-86, 1 pl.

Crampton, G. C. (1923). Preliminary note on the terminology applied to the parts of an insect's leg. Canadian Ent., 55:126-132.

Hayes & Kearns. (1934). The pretarsus (articularis) in Coleoptera. Ann. Ent. Soc. American, 27 : 21-33, 41 figs.

MacGillivray, A. D. (1923). External insect-anatomy. Urbana, Ill.

deMeijere, J. C. H. (1901). Ueber das letzte Glied der Beine bei den Arthropoden. Zool. Jahrb., Anat. 14:417-476, pls. 30-37.

Snodgrass, R. E. (1925). Anatomy and physiology of the honey-bee. McGraw-Hill Co., New York.

———— (1927). Morphology and mechanism of the insect thorax. Smithsonian Misc. Coll., 80, No. 1, 108 pp., 44 figs.

———— (1929). The thoracic mechanism of a grasshopper and its antecedents. Smithsonian Misc. Coll., 82, No. 2, 111 pp., 54 figs.

Psyche, 1935 Vol. 42, Plate I.

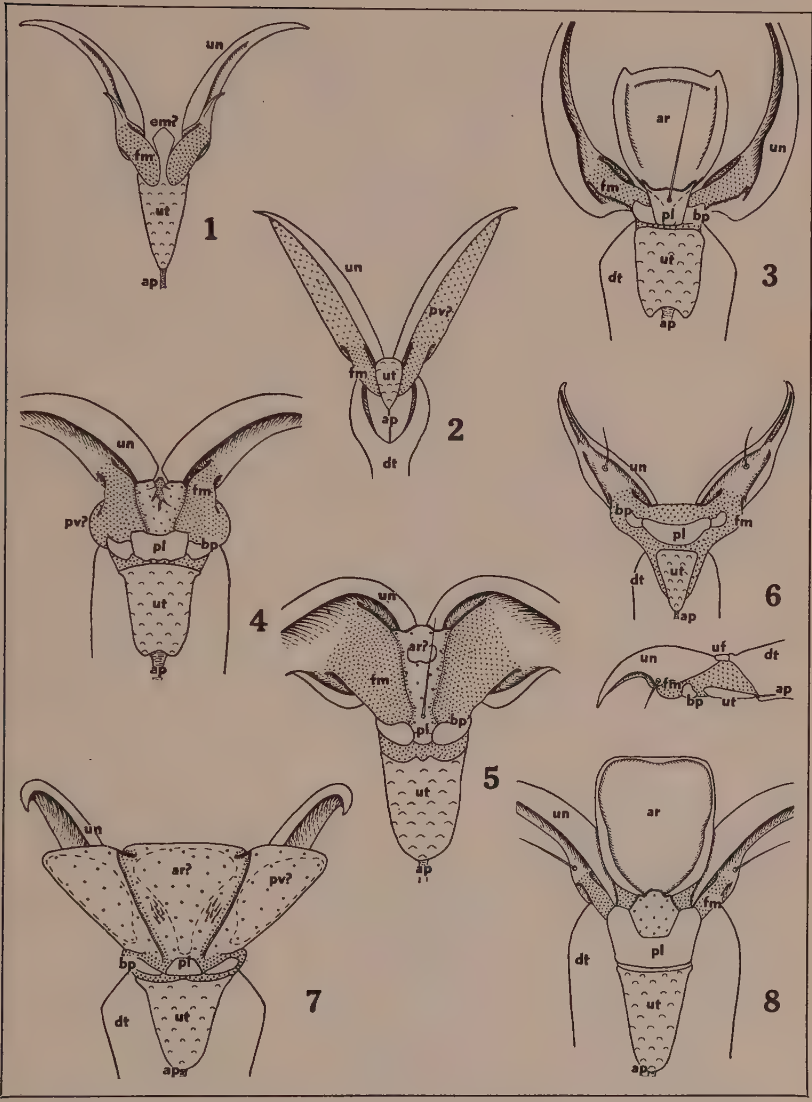


FIG. 1. *Anax junius* Drury.

FIG. 2. Siphlonurus sp.

FIG. 3. *Periplaneta americana* L.

FIG. 4. *Tenodera sinensis* Sauss.

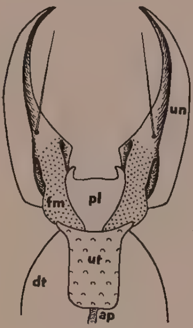
FIG. 5. *Termopsis angusticollis* Walker.

FIG. 6. Oligotoma sp.

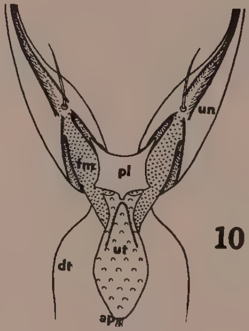
FIG. 7. *Pteronarcys dorsata* Say.

FIG. 8. *Melanoplus bivittatus* Say.

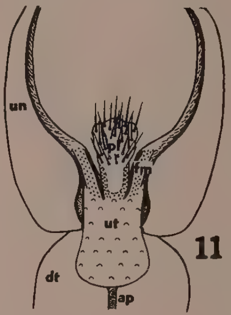
Psyche, 1935 VOL. 42, PLATE II.



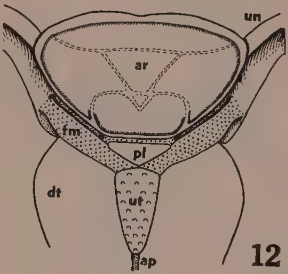
9



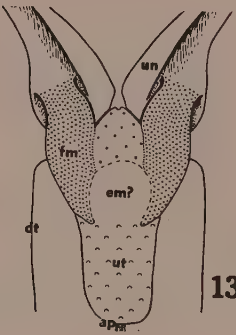
10



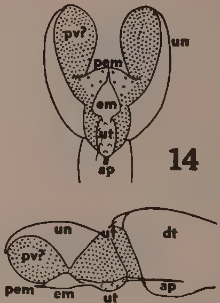
11



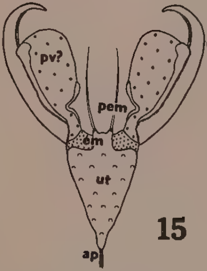
12



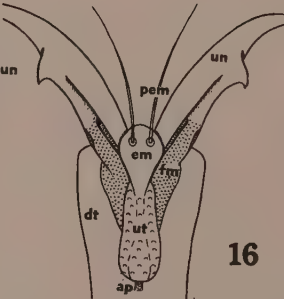
13



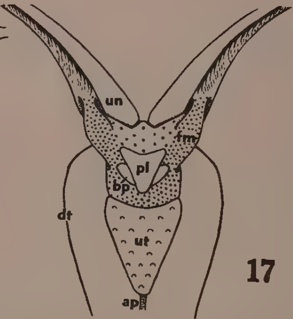
14



15



16



17

FIG. 9. *Ceuthophilus maculatus* Say.

FIG. 10. *Gryllus pennsylvanicus* Burm.

FIG. 11. *Gryllotalpa borealis* Burm.

FIG. 12. *Anisomorpha buprestoides* Stoll.

FIG. 13. Psalis sp.

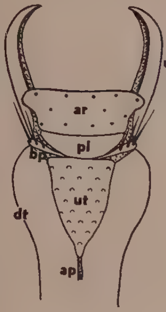
FIG. 14. *Agallia constricta* Van Duzee, ventral and lateral views.

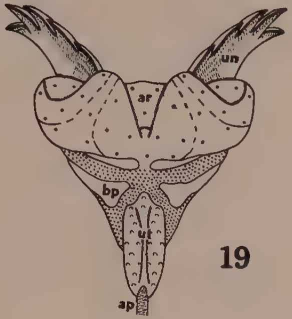
FIG. 15. *Brochymena arborea* Say.

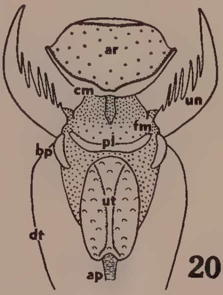
FIG. 16. *Phyllophaga fusca* Froelich.

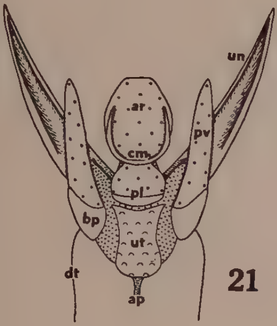
FIG. 17. *Corydalis cornuta* L.

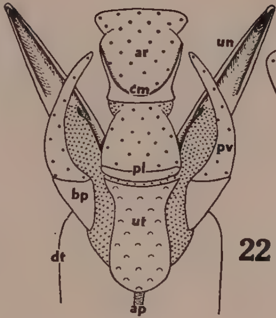
Psyche, 1935 Vol. 42, Plate III.

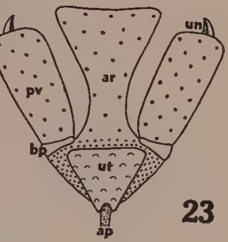


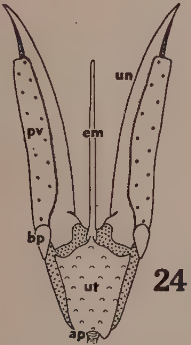


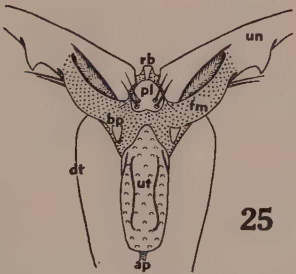












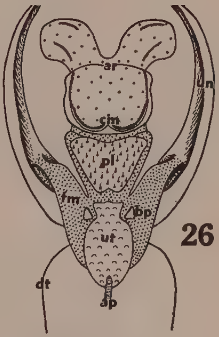


Fig. 18. Ithone sp.

Fig. 19. *Mantispa brunnea* Say.

Fig. 20. *Panorpa rufescens* Rambur.

Fig. 21. *Astenophylax argus* Harris.

Fig. 22. *Automeris io* Fabr.

Fig. 23. *Tabanus atratus* Fabr.

Fig. 24. *Diogmites umbrinus* Loew.

Fig. 25. *Tremex columba* L.

Fig. 26. *Chalybion caeruleum* L.

ABBREVIATIONS

ap — apodeme
ar — arolium
ar? — arolium (doubtful)
bp — basipulvillus
cm — camera
dt — distitarsus
em — empodium
em? — empodium (doubtful)
fm — flexor membrane
pem — parempodium
pl — planta
pv — pulvillus
pv? — pulvillus (doubtful)
rb — orbicula
uf — unguifer
un — ungues
ut — unguitractor

Except where otherwise noted the pretarsi figured were taken from the right meta-tarsus and are ventral views.

THE BIOLOGY AND MORPHOLOGY OF THE IMMATURE STAGES OF *MACROCERA ANGLICA* EDWARDS.

BY S. MADWAR, PH.D. (CANTAB.) M.B., CH.B. (EDINB.)
D.T.M. & H. (LOND.)

Research Institute and Endemic Diseases Hospital,
Public Health Department, Cairo, Egypt

The early stages of this fly are unknown and they are here described for the first time. The remarkable shape of the larva, resembling more a small earth-worm than the larva of a fly, makes it an interesting object of study.

The records of the British Museum show that the fly was found in the New Forest, Stocken Church, Crowborough and Welwyn. Moreover, I have seen specimens of this fly from Egypt in the British Museum. They were darker than the English type.

I found the larvæ of Macrocera under the loose bark of damp moist logs of oak, ash and elm in Richmond park and Epping forest near London. The bark was stripped gently, and the larvæ were found living separately each under its own web of saliva. The web is hygroscopic and on it are suspended droplets of clear fluid. The web consists of fine threads about three to four inches long. In constructing this web, the larva anchors one end of its slimy salivary thread to the bark; the head is then raised, and the thread is worked forwards and backwards. Inside the web, a stouter thread runs from one end to the other.

The movements of the larva are very characteristic. It glides with greatest ease and even with rapidity over the even surface of fungoid growth covering the bark. In doing so, it is assisted by the fine threads which it emits so as to bridge over these inequalities. It moves forwards and backwards with equal facility. Sometimes it turns by reversing its head and gliding along its side.

When the larva is full-grown, it advances to one extremity of the web and forms outside it a curious little mass of silken matter, so irregularly formed that it is scarcely entitled to be called a cocoon. The body is then shortened and the thoracic region is markedly thickened. The skin of the larva splits along the mid-dorsal line and the pupa draws itself forward leaving the old larval skin behind. If undisturbed, the imago often remains quiescent for 3 to 4 days, but will rush out with amazing celerity at the slightest disturbance.

Luminosity

In a closely related species, *Ceroplatus sesioides*, Whalberg (1848) was the first to state that the larva and pupa of Ceroplatus were luminous. Norris (1894) gave an account of the luminosity of the New Zealand "glow worm." He further suggested that the light emitted from the larva helped to attract small insects which the larva readily devoured.

Wheeler and Williams (1916) described the luminous organs in the New Zealand "glow worm," *Bolitophila luminosa*[1] as consisting of "the dilated tips of the four malpighian tubules which appear as four curved luminous rods and therefore constitute the photogenic organ." Hudson (1926) stated that the light emitted was brighter on warm damp nights and brightest immediately before daybreak.

In Macrocera and Ceroplatus which I reared in my bedroom, I carefully looked for luminosity in the larval and pupal stages of these insects, for several nights, and in no case was it seen. It is probable that the luminosity in the European *Ceroplatus sesioides* recorded by Wahlberg was due to phosphorescent bacteria as is the case in certain chironomus larvæ.

---

[1] Dr. F. W. Edwards kindly sent me some larvae of the New Zealand "glow worm." From the morphology of the larva, it is clear to me that the larva is related to the European Ceroplatus and not Bolitophila. Hudson later introduced the name *Arachnocampa luminosa* for the New Zealand "glow worm."

Food of Macrocera

Most Mycetophilid larvæ feed on fungus spores, hence their old name Fungivoridæ. Some species are said to be carnivorous.

Norris, Wheeler and Williams attribute a carnivorous habit to the New Zealand "glow worm."

Hudson bred the larva in small tanks by feeding them with small flies which he regularly introduced. Thus, he said, "There was in fact practically nothing else in the tank which could have sustained the larva during the three and half months they have been in captivity and accounted for the speedy disappearance of the numerous flies so frequently introduced."

Cheetham recorded a carnivorous habit for *Polylepta leptogaster* and Hungerford stated that *Sciara coprophila* fed on the dead bodies of the adults of their kind.

Mansbridge and Buston showed that the droplets of fluid in the webs of Platyura and Ceroplatus contain oxalic acid of sufficient strength to kill insects coming in contact with it. The excretion of oxalic acid by such larvæ is unexpected as it is by no means a product of larval metabolism. Such excretion is an aid to their carnivorous habit.

I have examined by transparency several young Platyura, Macrocera and Ceroplatus and found their gut containing fungus spores. In two instances, I found the remains of some Collembola in the web of Macrocera, but such remains form a nice nidus for fungal growth. It is probable that these larvæ may be partly carnivorous and partly fungivorous.

The larvæ of *Polylepta leptogaster* and *Sciara coprophila* are undoubtedly fungus eaters. It is evident that the carnivorous habit in Mycetophilidæ should be restricted to the web spinning species, namely the Ceroplatinæ, Macrocerinæ and Platyurinæ.

Morphology

The mature larva (Fig. 1, Pl. 4) is 20 mm. long and 1.5 mm. broad. The dorsal surface is convex and the ventral is flat. The larva is more like a small annelid worm or as Dufour said of the larva of Ceroplatus, "Elle est larve de diptère par sa partie antérieure et annelide par la reste du corps." The larva is yellowish in colour especially towards the posterior half. The anterior four and last body segments are moderately pigmented.

The integument is thin, polished and shining. The body of the larva is free from hairs except for six groups of sensory hairs situated in the three thoracic segments in direct relationship of the imaginal buds of the legs. Each group consists of four hairs of equal length.

The body of the larva is composed of 12 body segments; the first four of which are smaller and quite distinct from the rest. They are rectangular in shape and the sides are produced into small sacs. The skin of the other body segments is thrown into numerous transverse folds. Each fold is produced into a small sac at the sides. In preserved material, the last 8 body segments are difficult to make out on account of the transverse folds; thus in the closely related genus Ceroplatus, Réaumur thought the body segments were innumerable, while Husdon counted 19 body segments in the New Zealand "glow worn." The last body segment (fig. 8) is provided with two conical papillæ which are of variable size according to their state of turgescence.

The head (Figs. 2, 3) is quadrate, dark brown and partly retractile in the first body segment. The frontal plate is egg-shaped with the pointed end situated on the posterior margin. The latter shows two deep lateral emarginations. The lateral epicranial plates curve towards the ventral surface of the head and meet anteriorly leaving a bell-shaped area covered with transparent chitin (Fig. 3). Anteriorly, each plate sends two tongue-shaped pieces of chitin which articulate with the condyles of the mandible.

The antenna (an. Fig. 2) is convex and resembles a watch glass. It is supported by a strongly chitinised base and an annular band of chitin outside which four minute papillæ are present.

The eyes (E. Fig. 3) are small vestigial structures situated postero-lateral to the antennæ. Each consists of a transparent membrane overlying a layer of pigmented cells.

The labrum (Fig. 4) is supported by a well developed chitinised frame which adjoins the frontal plate. The lateral ends of the frame articulate with two well developed arms (c.r.) which pass ventral to the labrum. Each arm is provided with a fan-shaped organ, composed of several curved teeth, whose forward and backward movements help to direct the food particles towards the mouth opening. The labrum is a fleshy hood-like protuberance extending forward and downwards to recurve within the mouth. It is provided with 8 pairs of dorsal papillæ.

The mandible (Fig. 5) is elongated and consists of a convex dorsal and a large flat ventral lamella. The dorsal lamella is provided with one tooth and a well developed prostheca at the inner basal angle. On the medial border, the mandible carries three teeth and a small rounded tubercle.

The muscles operating the mandible are well developed and consist of an abductor and an adductor muscle. The abductor muscle (ab. m. Fig. 5) takes it origin from the posterior and lateral side of the epicranial plate and consists of five bundles which converge towards the upper slender tendon which is inserted to the upper angle of the mandible. The adductor muscle (ad.m) arises partly from the lateral and partly from the ventral surface of the epicranial plate. The ventral and dorsal bundles converge towards the adductor tendon to be inserted at the inner basal angle of the mandible ventral to the prostheca.

The maxillæ lie ventral and parallel to the mandibles. Each maxilla (fig. 6) consists of two lobes. The inner lobe or maxilla proper is cultriform and carries seven teeth, the last of which is strongly chitinised and more rounded than the rest. The outer lobe is provided with an oval area anteriorly, which is covered with a transparent membrane and bears one large circular and five small sensory papillæ. The maxilla is produced posteriorly as a strongly chitinised rod which serves for the attachment of the adductor muscle. The two maxillæ are supported along their posterior border by two triangular plates—the maxillary plates (mx. pl. Fig. 3)—which meet along the mid-ventral line.

The maxilla is provided with an adductor and an abductor muscle. The first consists of several bundles which arise from the apex and lateral margin of the occipital foramen and are inserted to the rod-shaped process of the maxilla.

The adductor muscle takes its origin from the lateral side of the epicranial plate. It consists of several bundles which converge to a long slender tendon which is inserted to the outer basal angle of the maxilla.

The hypopharynx (Fig. 7) lies dorsal to the maxillæ. It consists of two horizontal and two vertical processes. The free ends of the latter are seen between the inner borders of the maxillæ (hy, Fig. 3). Following them anteriorly, they pass dorsal to the maxillæ, slightly diverging one from the other and end by articulating with the horizontal processes. The horizontal processes resemble chamois horns. They meet anteriorly at the mid-ventral line and support a semicircular membrane whose free border carries several sensory papillæ (sp. Fig. 7).

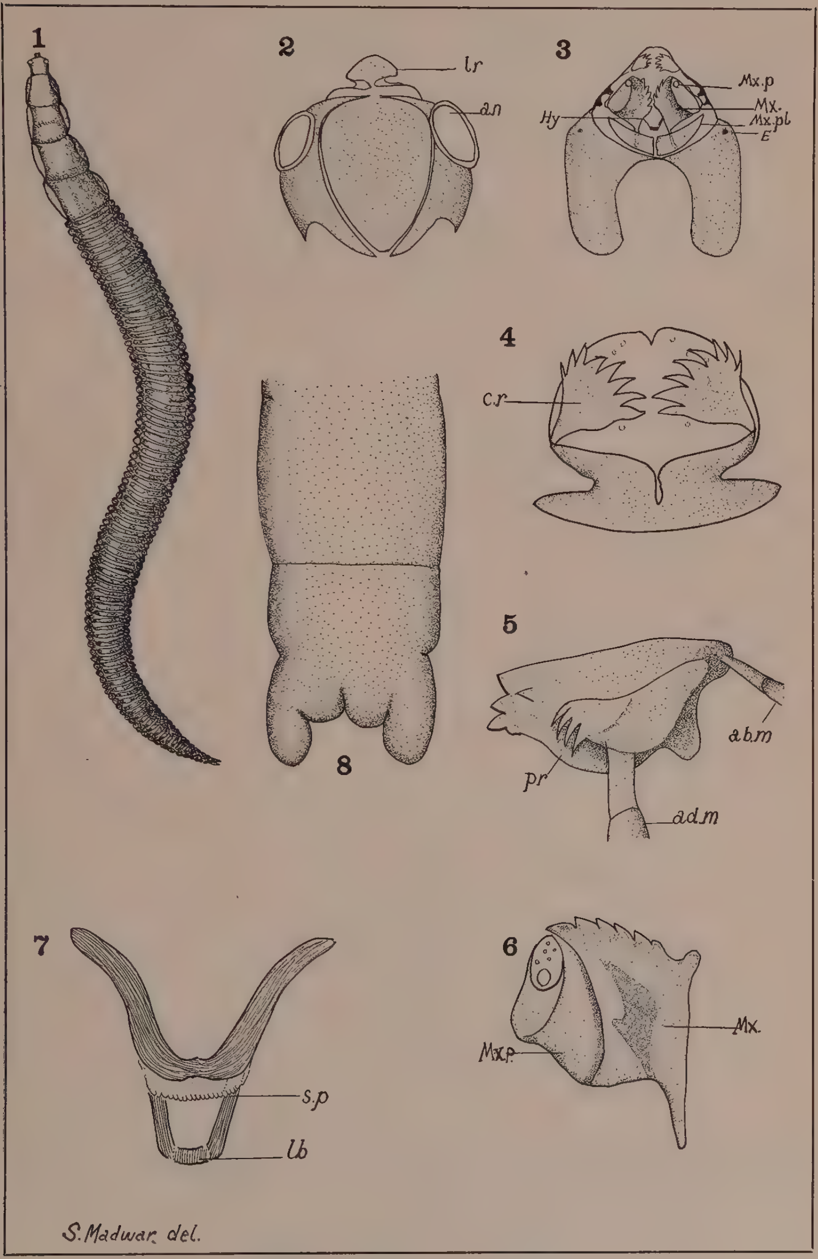
The labium (lb. Fig. 7) is reduced to a small rectangular plate situated between the free ends of the vertical processes. The opening of the salivary duct lies dorsal to the labium.

The alimentary canal consists of a short pharynx followed by a narrow tubular œsophagus which is invaginated in the proventricules. The mid-gut is in the form of a straight tube which gradually narrows down as it joins the hind-gut. The junction of the mid with the hind-gut is marked by four malpighian tubules which arise separately and extend forward, then backwards surrounding the hind-gut. From the anterior end of the mid-gut, two gastric cæca arise separately and extend backward to the 6th body segment. In the living larva, the cæca exhibit strong peristaltic movements. The two salivary glands are in the form of two long narrow convoluted tubes which extend to the 8th body segment. Anteriorly, they unite to form a common duct which opens between the distal ends of the vertical processes of the hypopharynx.

Respiratory System

The larvæ of Macrocera, Ceroplatus and Platyura are apneustic. The tracheal system is well developed in Macrocera, consisting of two latero-dorsal longitudinal trunks which extend from the first to the last body segment. The two trunks are connected together by 8 transverse branches situated at the end of the metathorax and the first seven

Psyche, 1935 VOL. 42, PLATE IV.



Madwar — *Macrocera anglica.*

abdominal segments. From each trunk, eight short lateral branches take their origin, which are connected to the skin of the prothorax and first seven abdominal segments by means of lateral cords which correspond to the position of the spiracles in other Mycetophilid larvæ.

Although functioning spiracles are absent in this larva, the conditions for cutaneous respiration are extremely favorable[1]. The skin is thrown into numerous folds which increase the respiratory surface. The integument is thin and richly supplied with a subcuticular net of tracheoles. The larva lives under a hygroscopic web of salivary secretion.

Description of Plate 4

Macrocera anglica Edwards.

Fig. 1	Whole larva taken out of web	X 10
Fig. 2	Head — Dorsal aspect	X 72
Fig. 3	Head — ventral aspect	X 72
Fig. 4	Labrum — oral aspect	X 250
Fig. 5	Mandible	X 250
Fig. 6	Maxilla	X 250
Fig. 7	Hypopharynx and Labium	X 250
Fig. 8	Terminal body segment	X 72

Key to Lettering of Plate

An.	Antenna
Ab.m.	Abductor muscle
Ad.m.	Adductor muscle
C.R.	Chitinous ring
E.	Eye
Hy.	Hypopharynx
Lb.	Labium
Mx.	Maxilla
Mx.P.	Maxillary Palp
Mx.Pl.	Maxillary Plate
Pr.	Prostheca
S.P.	Sensory Papilla

---

[1] The modification of the respiratory system in some Dipterous larvae will be dealt with separately in a special paper.

Summary

1. The Biology and Morphology of *Macrocera anglica* is given.
2. Luminosity, development of carnivorous habits and the excretion of oxalic acid by the larva are discussed.
3. The change from the peripneustic to the apneustic condition in the larva of Macrocera is accounted for.

Acknowledgement

I wish to thank Prof. M. Khalil Bey, Director of the Research Institute, for his advice and helpful criticism.

References

Cheetham, C. A.
1920 *Polylepta leptogaster* Winn. A Cave-dwelling Dipterous larva in Yorks. Naturalist, vol. 45, p. 189.

Dufour, L.
1839 Monographie du genre Ceroplatus. Ann. Soc. Nat. 2me. série, vol. XI, p. 193.

Edwards, F. W.
1924 British Fungus Gnats. Trans. Ent. Soc. London, 1924, pp. 505-670; Ann. Mag. Nat. Hist., 9th ser., vol. XIV, p. 175.

Enslin, E.
1906 Die Lebensweise der Larve von *Macrocera fasciata* Meig. Zeits. Wiss. Insektbiol., vol. 2, pp. 251-253.

Hudson, G. V.
1926 Observations made on the New Zealand Glowworm (*Arachnocampa luminosa*) During 1926. Ann. Mag. Nat. Hist., London, 9th ser., vol. XVIII, pp. 667-670.

Hungerford, H. B.
1916 Sciara maggots injurious to potted plants. Journ. Econ. Ent., vol. 9, pp. 538-549.

Madwar, S.
The Biology and Morphology of the Immature Stages of Mycetophilidæ. Philos. Trans. Royal Soc. London (in press).

Malloch, J. R.
1917 Key to the Larvæ of Diptera. Bull. Illinois Lab. Nat. Hist., No. 12, pp. 161-409.

Mansbridge, G. H.
1933 On the Biology of Some Ceroplatinæ and Macrocerinæ. Trans. Ent. Soc. London, vol. LXXXI, pp. 75-92.

Norris, A.
1894 Observations on the New Zealand Glow-worm, *Bolitophila luminosa.* Ent. Monthly Mag., vol. 30, pp. 202-203.

Réaumur
1740 Mémoires, vol. V, p. 23.

Schmitz, H.
1912 *Polylepta leptogaster.* Natuurhistorisch Genootschap, Limburg, Jaarboek, pp. 65-96.

Wheeler, W. M. and F. X. Williams.
1915 The Luminous Organ of the New Zealand Glow-worm. Psyche, vol. 22, No. 2, pp. 36-43.

TWO NEW ANTS COLLECTED IN QUARANTINE

By W. M. Mann

National Zoological Park, Washington, D. C.

The writer has for some years had the privilege of seeing and identifying the ants collected at the various quarantine stations of the United States Government. These are intercepted from all parts of the world, and during the course of years a great many species have been received. There is of course a preponderance of certain common tropical species, but occasionally great rarities come in.

During the past year two most interesting species have been sent from the station at Honolulu, one a *Macromischa*, the other a second species of the genus *Zatapinoma*, both of which seem worth while recording here.

Macromischa luciliæ n. sp.

Worker (Fig. 1)

Length 2.75 mm.

Head a little longer than broad, slightly narrower in front than behind, with moderately convex sides, broadly rounded occipital corners and nearly straight borders. Clypeus, convex, truncate in front; frontal area large and strongly impressed. Eyes convex, situated slightly in front of middle side of head. Antennal scapes barely surpassing occipital corners; first funicular joint as long as the two following joints together; joints 2-9 sub-equal in length, slightly broader than long; club elongate; the terminal joint as long as the two preceding joints together. Thorax in profile very arcuate, without distinct sutures; epinotal spines stout, nearly straight, as long as the epinotal declivity. Postpetiole long and slender; the peduncle twice as long as the node, which rises abruptly and is higher than long and from above broader than the node and 1½ times as broad as long. Femora, especially posterior pair, thickened.

Head and thorax closely punctate and sublucid, the thorax and epinotum more closely than the head; petiole, postpetiole and gaster shining; legs finely and densely punctate and shining. Hair moderately abundant on head, thorax and abdomen, erect and very coarse, whitish in color.

Color piceous except the anterior half of the epinotal spines which are ivory white; legs and antennæ somewhat lighter.

Described from a small series of workers taken in quarantine at Honolulu on roots of *Oncidium splendidum*, from Guatemala.

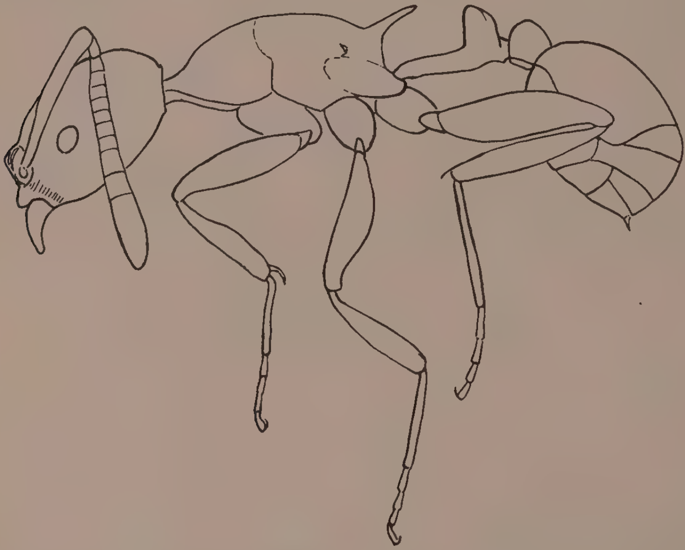


Fig. 1. *Macromischa luciliae* sp. nov. Worker. Profile view.

A very distinct species, superficially resembling *albaspina* from Mono Island, but much larger, more shining and with entirely different petiole.

Co-types No. 50802, U. S. National Museum.

Zatapinoma wheeleri n. sp.

Soldier (Fig. 2)

Length 2.75 mm.

Head nearly twice as long as broad and broader in front than behind, with straight parallel sides, broadly rounded occipital corners and very shallowly concave borders. Eyes elongate, very slightly convex with nine facets in their greatest longitudinal diameter. Mandibles large and thick, their inner blades with five coarse teeth. Clypeus nearly straight at anterior border; surface at sides with two strong nearly parallel carinæ, the surface moderately convex. Funicular scapes extending about 5/8 the distance to occipital corners, slightly thickened apically; funiculi moderately enlarged toward the tip, the first joint longer than the second and third together; joints 2-10 broader than long; terminal joint longer than the two preceding joints together. Thorax robust, pronotum more than twice as broad as long, broader in front than behind and with nearly straight sides; mesonotum from above 1½ times as long as pronotum, narrowed posteriorly; mesoepinotal suture very distinct; epinotum a little longer than broad in profile, with convex base and declivity; petiole sub-rectangular.

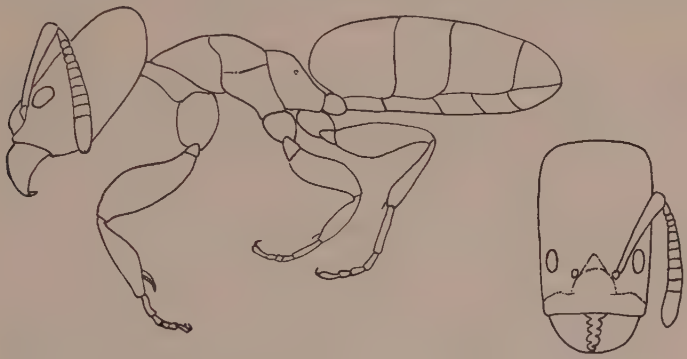


FIG. 2. *Zatapinoma wheeleri* sp. nov. Worker. Profile view and dorsal view of head.

Moderately shining except mandibles and clypeus which are shallowly but densely punctate and opaque, the remainder smooth. Hairs very sparse, pubescence very fine and short, yellow in color, both abundant on head.

Color pale yellowish brown.

Described from three soldiers taken in quarantine at Honolulu on plants from Samoa.

Co-types No. 50801, U. S. National Museum.

The only other described species, *Z. annandalei*, recently described from India by Wheeler, differs in having the head broader, the mandibular teeth smaller and more numerous, and the clypeal area darker than the rest of head.

NEW ANTS FROM THE PHILIPPINES

By William Morton Wheeler

Biological Laboratories, Harvard University

The following species and subspecies are selected for description on account of their unusual interest from several rich collections of Philippine ants received from Dr. J. W. Chapman, Dr. F. X. Williams, Dr. R. C. McGregor and others.

Metapone gracilis sp. nov.

Female. Length 7 mm.

Head suboblong, about two-fifths longer than broad, slightly broader in front than behind, with feebly concave sides and somewhat sinuate posterior border. Eyes large, rather flat, about one and one-half times as long as their distance from the anterior corners of the head. Anterior ocellus distinctly larger than those of the posterior pair. Mandibles convex, with oblique, coarsely and bluntly 5-toothed apical and straight external borders. Median portion of clypeus trapezoidal, flat, sloping, slightly narrowed in front, with straight sides, posterior suture slightly arcuate, not impressed, anterior border only slightly projecting in the middle where it terminates in a pair of broad, blunt teeth. Frontal carinæ subparallel behind, their anterior lobes obtusely angular. Frontal groove distinct. Antennal scapes flattened, nearly four times as long as broad; club of funiculi large, flat, much longer than the remaining joints together, the terminal joint longer than broad, as long as the combined two preceding joints; joints 2-7 much broader than long but gradually increasing in length distally. Thorax slender, nearly four times as long as broad, subhexagonal from above, widest at its middle where the wings are inserted. Pronotum nearly as long as broad, with straight, anteriorly converging, scarcely submarginate sides. Mesonotum somewhat broader than long, flattened above, with arcuate promesonotal suture. Scutellum semicircular, flat. Epinotum longer than broad, in profile sharply rectangular behind, the base feebly convex, about four times as long as the abrupt and slightly concave declivity. Petiolar node flattened above, about one and one-third times as long as broad, distinctly broader behind than in front, with sharp anterior and posterior corners, straight, marginate sides and anterior border and arcuately excised posterior border; in profile somewhat longer than high, the anterior surface of the nodes straight and perpendicular, the dorsal surface straight and horizontal, the posterior surface concave, the ventral surface anteriorly with a laterally compressed, triangular, translucent lamella and posteriorly with a thick, transverse projection. Postpetiole subelliptical, broader than long, somewhat broader than the petiole and slightly narrower in front than behind, its dorsal surface feebly convex in profile, perpendicularly truncated anteriorly, its ventral surface with a transverse welt anteriorly. Gaster slender, more than three times as long as broad, first segment decidedly longer than broad, the second broader than long. Legs short, shaped as in the other species, the flattened, middle and hind femora less than twice as long as broad. Wings short, measuring only about 4 mm.

Moderately shining mandibles coarsely striate-punctate; clypeus, head an throax evenly, longitudinally rugulose; pedicel and gaster finely reticulate, with coarse, sparse, piligerous punctures; scapes and legs smoother and more shining, with finer and more scattered punctures.

Pilosity yellowish, short and moderately abundant, oblique on the head and thorax, longer on the legs and abdomen, appressed or subappressed on the latter; anterior border of pronotum with a few conspicuously long, erect hairs. Wings covered with short, brown hairs.

Black; mandibles, clypeus, anterior borders of cheeks and posterior borders of postpetiole and gastric segments reddish brown; tips of scapes, funiculi, trochanters, basitarsi, tips and bases of femora and tibiæ more yellowish brown; remaining tarsal joints yellow. Wing membranes brownish; veins and peterostigma dark brown.

Described from a single specimen captured by Prof. C. F. Baker at Dapitan, on Mindanao Island, Philippines.

M. gracilis belong to the group of species comprising *bakeri* Wheeler of the Philippines, *tillyardi* Wheeler of New South Wales, *johni* Karawajew of Ceylon and *jacobsoni* Crawley of Sumatra and characterized by having the clypeus narrowed and blunt or bidentate anteriorly instead of terminating in a rectagular lobe with acute corners. Crawley mentions two female specimens under his description of *jacobsoni*, taken in April and October, 1914, respectively. The former he regards as the type of *jacobsoni*, the latter, which is very similar to the female described above, is, I believe, specifically different. There must be several closely related, still undescribed species of Metapone in the Indomalayan and Indonesian regions. I possess males of two species from Singapore and Luzon Island, which differ from the one I described as *hewitti* from Borneo, but I refrain from describing them till the cospecific females or workers turn up.

Prosopidris subgen. nov. (of Cardiocondyla)

Worker. Minute and closely related to Cardiocondyla. Antennæ very similar, but 11- instead of 12-jointed. Clypeus much larger, thick and swollen, perpendicularly truncated anteriorly and forming on each side a strong, oblique welt which bounds the antennal fossa. Thorax stout and rather high, evenly arcuate above in profile, without promesonotal and mesoëpinotal sutures and mesoëpinotal impression; epinotum armed with a pair of stout spines. Petiole much as in Cardiocondyla but the node more concave anteriorly; postpetiole large, broader than the petiolar node, as in that genus. Gaster consisting very largely of the first segment. Sting well-developed, short and stout. Middle and hind tibiæ without traces of spurs; tarsal claws very small, simple. Pilosity lacking except on the mandibles and clypeus; sculpture feeble as in Cardiocondyla.

Female. Not much larger than the worker and very similar to the female of Cardiocondyla in the structure of the thorax. Postpetiole not more enlarged in proportion to the petiolar node than in the worker. Wing-venation much as in Cardiocondyla with narrow pterostigma near the middle of the costal border, a single narrow cubital cell, no discoidal cell, and only a short basal piece of the radial vein, but with a well developed discoidal vein.

Subgenotype: *Cardiocondyla* (*Prosopidris*) *sima* sp. nov.

Cardiocondyla (Prosopidris) sima sp. nov. (Fig. 1)

Worker. Length 2-2.2 mm.

Head subrectangular, longer than broad, nearly as broad in front as behind, with straight, subparallel sides, broadly rounded posterior corners and feebly sinuate posterior border. Eyes moderately large and convex, somewhat longer than their distance from the clypeus. Mandibles convex, 5-toothed, the two apical decidedly larger than the basal teeth. Clypeus projecting over the bases of the mandibles, its anterior truncated surface flattened, its posterior portion extending back between the frontal carinæ large, convex, subtriangular, its anterior border transverse, feebly sinuate in the middle and more deeply sinuate on each side. Frontal area small, triangular, impressed and rather indistinct; frontal groove distinct anteriorly. Antennæ slender, scapes nearly straight, extending somewhat beyond the posterior corners of the head; second funicular joint longer than broad, joints 3-7 as long as broad, the two basal joints

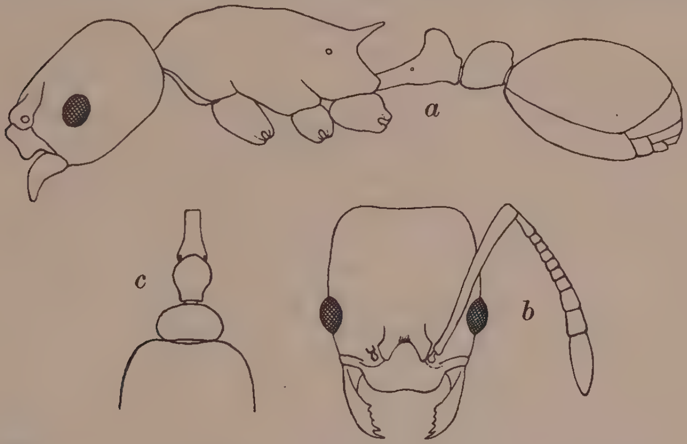


FIG. 1. *Cardiocondyla* (*Prosopidris*) *sima* sp. nov. Worker; *a,* in profile; *b,* head, dorsal view; *c,* petiole and postpetiole, dorsal view.

of the club longer than broad, subequal, together shorter than the distinctly swollen terminal joint. Pronotum with the neck as long as broad, with broadly rounded humeri; mesonotum broader than long, narrowed posteriorly where the pleuræ are distinctly compressed; epinotum longer than broad, slightly narrowed anteriorly, its posteriorly sloping base one and two-thirds times as long as the perpendicular declivity, which is concave in the middle and marginate on the sides, metasternal angles prominent but rounded, the spines straight, blunt and stout, nearly as long as the distance between their bases but shorter than the declivity, directed backward and outward and slightly upward. Peduncle of petiole as long as the node, which is as high as long, rounded above and distinctly broader than long. Post-petiole transversely elliptical, lower and nearly twice as broad as the petiolar node, convex anteriorly, with its straight posterior border. Gaster broadly elliptical, convex, with broadly concave anterior border. Legs rather long.

Thorax, pedicel and gaster distinctly shining, microscopically and superficially reticulate or punctulate; mandibles, clypeus, head and appendages more opaque, the head and anterior portion of pronotum more sharply and coarsely punctulate and also covered dorsally with shallow and not very distinct foveolæ.

Pilosity and pubescence yellowish, the former consisting of a few short, sparse, erect hairs on the clypeus and mandibles, the latter fine, dilute, appressed, longer and more distinct on the gaster and appendages.

Dull yellowish brown or pale ferruginous, the head very slightly darker, the mandibles, clypeus, peduncle of petiole and appendages slightly paler. Mandibular teeth dark brown.

Female. Length 2.7-2.8 mm.

Very similar to the worker; joints 3-7 of funiculi distinctly broader than long; thorax short, as broad as the head; pronotum somewhat flattened, broader than long, subtriangular anteriorly; epinotal spines shorter and stouter than in the worker, subparallel; petiole and postpetiole not enlarged as compared with the worker.

Sculpture and pilosity as in the worker except that the whole thorax above is foveolate-punctate like the head, and the thorax, nodes of pedicel and gaster are darker and less yellowish, being as dark as the head. Wings grayish; veins brown, pterostigma dark brown.

Described from eight workers and four females collected by Mr. L. M. Morato at Dansalan, on Lanao Island, Philippines, and received from Dr. J. W. Chapman.

Dilobocondyla chapmani Wheeler subsp. **rufobrunnea** subsp. nov.

Worker. Length 3.8 mm.

Differing from the typical *chapmani* in its slightly larger size, slightly more opaque surface throughout and in coloration, being dark brown, with the pronotum above paler and more rufous, the mandibles, except the teeth, the sides of the clypeus, scapes, first funicular joint and tarsi beyond their first joint, brownish yellow.

Female. Length 4.5 mm.

Very similar to the worker, but the gular surface of the head and the thorax are paler and more reddish than the head and gaster, the postscutellum and posterior portion of the mesonotum infuscated. Wings shorter than the body, whitish, with pale brown veins and dark brown peterostigma. The radial cell is short and closed, there is a single cubital but no discoidal cell.

Male. Length 4.3 mm.

Head broader than long, transversely elliptical, with large eyes and moderately large ocelli. Cheeks short and strongly converging anteriorly. Mandibles well-developed, flattened, 5-toothed, the two basal teeth small. Clypeus broad, feebly convex, its anterior border broadly rounded, entire, sinuate on each side. Frontal area large; frontal carinate short, low and subparallel. Antennæ long, 13-jointed; scapes very short, only about twice as long as broad; first funicular slightly longer than broad, not swollen, remaining joints cylindrical, the second twice as long as the scapes, the remaining joints shorter, except the last, which is nearly as long as the second and somewhat swollen. Thorax through the mesonotum somewhat broader than the head; pronotum very short, mesonotum large and convex, with very pronounced notauli (Mayrian furrows); epinotum higher than long, with subequal base and declivity, the former distinctly convex, the latter flattened, perpendicular and marginate on each side. Petiole and post-petiole similar to those of the worker, but more slender. Gaster small, elongate-elliptical; genitalia exserted, the stipites rather large, lobular, rounded at the tip. Legs long and slender but the femora distinctly incrassated in the middle, though less so than in the worker.

Somewhat shining; mandibles finely reticulate; head longitudinally rugulose, the clypeus and frontal area more finely and more regularly than the cheeks, the rugules of which curve around the antennal fossæ. The interrugal spaces are sharply and finely reticulate as in the worker. Sculpture of thorax similar; pronotum transversely, mesonotum longitudinally rugulose; scutellum more coarsely reticulate-rugulose, pleuræ and epinotal declivity smoother. Petiole, postpetiole and gaster shining, smoother, only superficially and microscopically reticulate.

Pilosity longer than in the worker, the hairs tapering and flexuous.

Black; scapes, gaster, coxæ and femora dark brown; base of gaster above somewhat infuscated; tibiæ, tarsi and funiculi white; first funicular joint strongly, tibiæ feebly tinged with reddish brown; wings whitish, veins colorless, pterostigma pale brown.

Single worker, female and male specimens collected by Mr. W. D. Pierce at Victoria, Negros Oriental, Philippines, and received from Dr. J. W. Chapman.

Emery, in the "Genera Insectorum" (p. 241) described with a query a male specimen of an undetermined species of Dilobocondyla from Sumatra. The foregoing description of the male collected with the cospecific worker shows that he really had a male Dilobocondyla, probably belonging either to *D. sebesiana* Wheeler or to *D. karnyi* Wheeler.

Zatapinoma williamsi sp. nov.

Soldier. Length nearly 3 mm.

Very similar to the soldier of *Z. annandalei* Wheeler of

India but differing in the following characters: Integument thicker and more rigid, clypeal swellings somewhat less pronounced and not bilobed or biprotuberant on each side; mandibles with 8 coarse teeth, the first, second and fourth larger than the others, the seventh and eighth fused; frontal area obsolete; funicular joints 3-8 as long as broad (in *annandalei* distinctly broader than long); eyes distinctly larger, situated a distance equal to their greatest diameter from the posterior clypeal border, which is more distinct than in the Indian species. Thorax more slender, the pronotum as long as broad, the epinotum slightly longer than broad.

Sculpture and pilosity very similar in the two species, but the color of *williamsi* is different, being brownish yellow instead of whitish yellow, the mandibles and clypeus are concolorous with the remainder of the head and the second to fourth gastric segments are brown at the base.

Female. Length 3.5 mm.

Resembling the soldier, but the head is proportionally smaller and somewhat more narrowed anteriorly, the eyes though flat are much larger, twice as long as their distance from the anterior corners of the head. Ocelli well-developed, near the occipital border. Clypeus without the peculiar lateral swellings of the soldier, feebly convex in the middle, depressed on each side. Frontal area large and indistinct. Antennal scapes reaching to the posterior fourth of the head. Thorax collapsed, but apparently as broad as the head, with flattened mesonotum. Gaster large, shaped like that of the soldier. Wings long, the anterior pair with long closed radial cell, a single long cubital but no discoidal cell. There are no traces of a pterostigma.

Sculpture and pilosity much as in the soldier, but the pubescence is more abundant and longer, especially on the gaster and the segments of this region also bear sparse and rather long, coarse hairs. Wings pubescent.

Clypeus and thorax brown; antennæ, head and legs brownish yellow; gaster pale yellow, with a broad, dark brown basal fascia on each segment. Wings hyaline, with very pale yellow veins.

Single soldier and female specimens taken by Dr. F. X. Williams as Los Banos, Luzon Island, Philippines.

This species is very close to *Z. wheeleri* described and figured by Dr. W. M. Mann in the present issue of "Psyche" from soldiers received from Samoa by the Federal Quarantine Station in Honolulu. This species, however, has 5-toothed mandibles and the funicular joints 2-10 are distinctly broader than long as in *Z. annandalei.* As I am not certain that the two specimens collected by Dr. Williams are from the same colony, only the soldier is to be regarded as the type.

Acantholepis aurea Karawajew subsp. **punctaticeps** subsp. nov.

Worker. Length 2 mm.

Head subtrapezoidal, slightly longer than broad, distinctly narrowed anteriorly, with feebly convex sides and posterior border and rounded posterior corners. Eyes at the middle of the sides of the head, moderately convex, as long as their distance from its anterior corners. Mandibles convex, with 5 subequal teeth. Clypeus convex, carinate, with broadly rounded, projecting anterior border. Frontal area obsolescent; frontal groove distinct anteriorly. Antennal scapes extending about one-fourth their length beyond the posterior border of the head. Pronotum with rounded humeri and convex sides and dorsal surface, decidedly broader than long; mesonotum transversely subelliptical, one and one-third times as broad as long; metanotum about two-thirds as broad as the pronotum, with prominent, dorsally projecting spiracles; the mesometanotal impression short but pronounced; epinotum somewhat narrower than the pronotum, subrectangular, the base on each side with a pair of stout longitudinal projections which terminate posteriorly in very blunt teeth bearing the epinotal spiracles at their tips. Petiolar scale thin, its summit acute and almost semicircularly excised, so that its corners from two blunt, flattened teeth which are about twice as long as broad at their bases, its sides and anterior surface somewhat convex. There is no peduncle-like prolongation behind the node.

Mandibles and clypeus shining, feebly and microscopically reticulate, the former with a few coarse piligerous punctures, remainder of head opaque, densely and finely punctate; thorax, petiole and appendages subopaque, sculptured like the head but more superficially; meso- and metapluræ longitudinally rugulose; gaster smooth and shining.

Hairs white, sparse, erect and obtuse, present only on the body; scapes and legs with fine, appressed, pale pubescence.

Head and thorax dark reddish brown; gula, occiput and epinotum darker and more blackish; mandibles, scapes, mesonotum, trochanters, tips of femora and tips and bases of tibiæ yellowish brown; funiculi fuscous; tarsi yellow, with the last joint brown; gaster black.

Two specimens taken by Dr. J. W. Chapman, one at Baguio, Luzon Island (type locality) and one Dumaguete, Negros Oriental, Phillippines. The second specimen seems to be somewhat immature. I have attached this form to *aurea,* recently (1932) described by Karawajew from Bantam, at the western end of Java, because it seems to differ only in the decidedly thinner petiolar scale, different sculpture of the head and much darker coloration. *Aurea* was the first species of *Acantholepis* to be described from Indonesia, all the other known species of this rather large genus being confined to the Eurasian and African continents, except the Indian A. *rothneyi wabsoni* Forel which occurs in Formosa. There is among my Philippine material, however, yet another species which is here described.

Acantholepis chapmani sp. nov. (Fig. 2)

Worker. Length 2.5-2.8 mm.

Head suborbicular, convex and rounded behind, including the mandibles slightly longer than broad. Eyes large, convex, somewhat behind the middle of the sides; ocelli large and widely separated. Mandibles moderately convex, 5-toothed, the first and fourth tooth from the apex larger than the others. Maxillary palpi very long. Clypeus large, evenly convex, ecarinate, with rounded, entire and projecting anterior border. Frontal area transversely triangular; frontal groove distinct. Antennæ slender; scapes extending two-fifths their length beyond the posterior border of the head; all the funicular joints fully twice as long as broad. Thorax shaped as in *A. frauenfeldi* Mayr but the anterior portion of the mesometanotal constriction is broader, though decidedly longer and more slender than in *aurea punctaticeps.* Pronotum one and one-third times as long as broad, flattened or slightly concave above, with distinctly protuberant humeri. Mesometanotum twice as long as broad, narrowed in the middle and bearing at its posterior fourth the dorsally projecting spiracles which are separated by a space four times their diameter. Epinotum from above subrectangular, nearly as broad as the pronotum and one-third broader than long, bearing on its anterior or basal half two large, thick, rapidly tapering, rather acute spines. Petiole long, with long posterior peduncle, the anteriorly placed scale inclined forward, convex anteriorly and posteriorly and moderately thick, bearing above at each corner of feebly concave, transverse summit a small, slender, acute spine which is directed upward, outward and slightly backward. Gaster rather large, subelliptical. Legs long and slender.

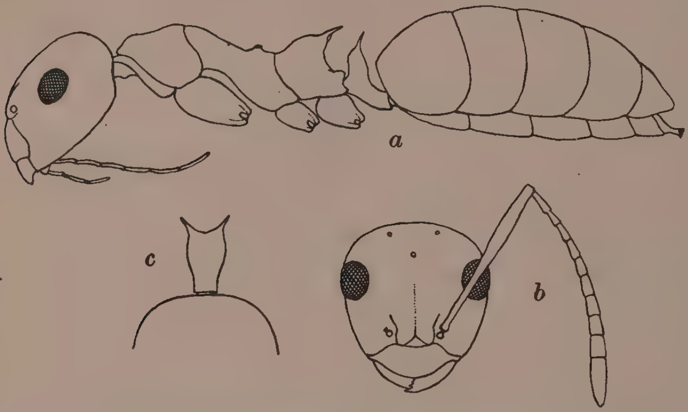


FIG. 2. *Acantholepis chapmani* sp. nov. Worker; *a,* in profile; *b,* head, dorsal view; *c,* petiole, posterior view.

Shining and very finely and superficially reticulate or shagreened; meso- and epinotum more opaque and more coarsely reticulate or densely punctulate and also sharply longitudinally rugulose, the rugules faint or absent anteriorly on the dorsal surface of the mesonotum; neck and posterior peduncle of petiole finely rugulose. Scapes and legs very delicately and densely punctulate.

Hairs and pubescence white, the former sparse, erect and rather short, most numerous on the head and gaster, absent on the appendages which are instead invested with fine, appressed or subappressed pubescence.

Yellow; meso- and epinotum, neck and posterior peduncle of petiole brownish; funiculi beyond the first joint, apical halves of hind femora, except their tips, and the tibiæ except their bases and tips, fuscous; mandibles, palpi and tarsi white; mandibular teeth reddish.

Female (deälated). Length 4.5 mm.

Resembling the female of *A. frauenfeldi,* but the head is proportionately smaller and broader, broader than long, subtrapezoidal. Antennæ shorter and stouter than in the worker. Thorax and petiole as in *frauenfeldi,* the former elliptical and depressed dorsally, with rounded, spineless epinotum, the latter with a decidedly thicker, spineless scale.

Opaque and much more sharply and densely punctulate throughout than the worker, except the thoracic sutures and an anteromedian impressed line on the mesonotum which are shining.

Pilosity much as in the worker but more abundant on the thoracic dorsum; pubescence distinct on the head, pronotum, gaster and legs; dense but rather short on the gaster.

Dull yellowish red; head somewhat paler; tarsi antennal scapes and first funicular joint yellow; remainder of funiculi brown; three broad, anteriorly fused vittæ on the mesonotum, the mesopleuræ, summit of petiolar scale, dorsum of gaster except the anterior portion of the first segment, dark brown or blackish.

Described from numerous workers and a single female taken by Dr. J. W. Chapman from two colonies nesting in galls on dead branches in the mountains near Dumaguete, Negros Oriental, Philippines.

Nesolasius subgen. nov. (of Pseudolasius)

Worker maxima. Resembling Pseudolasius but differing in the peculiar conformation of its mandibles, clypeus, frontal carinæ and eyes. Head large, subcordate, rather flat, deeply excised posteriorly. Eyes very small and indistinct, consisting of only a few ommatidia, in front of the middle of the head and on its dorsal surface as in Pseudolasius. Mandibles short, stout and convex, with only four very coarse, subequal teeth on the apical border, which is not oblique; the basal tooth apparently consisting of a fused pair of teeth. Clypeus very short, with a subrectangular median portion not extending back between the frontal carinæ, anteriorly abbreviated, with broadly concave anterior border, and short, band-like lateral portions extending to the sides of the head. Clypeal fossæ deep and pit-like. Frontal carinæ in the form of narrow lobes more closely approximated than in Pseudolasius, *sens. str.* conspicuously elevated, projecting above the surface of the head and bearing the antennæ beneath their anterior tips, bounded laterally by short scrobe-like impressions which are very narrowly confluent with the clypeal fossæ. Frontal area convex, lying between the frontal carinæ, continued posteriorly as a distinct median ridge instead of a groove and extending as far back as the middle of the head. Antennæ small, 12-jointed; scapes short. Thorax short and stout, shaped much as in Pseudolasius, with large, convex pronotum; metanotum distinct, with dorsolateral spiracles. Epinotal spiracles elliptical. Petiole, gaster and legs as in Pseudolasius.

Genotype: *Pseudolasius* (*Nesolasius*) *typhlops* sp. nov.

Pseudolasius (Nesolasius) typhlops sp. nov. (Fig. 3)

Worker maxima. Length 3.3 mm.

Head about one-fourth longer than broad, as broad in front as behind, with feebly and evenly convex sides and angularly excised posterior border. Eyes consisting of only 3 or 4 scarcely pigmented ommatidia. Clypeus convex in the middle, depressed on the sides. Antennal scapes reaching to the middle of the sides of the head; funicular joints 2-10 as long as broad, first joint as long as the three succeeding joints together, terminal joint as long as the two preceding. Thorax including the neck about twice as long as broad, pronotum as broad as long; mesonotum convex, rounded subtriangular, broader than long; epinotum nearly as broad as the mesonotum, its base broader than long, rounding into the longer, feebly concave and nearly perpendicular declivity. Petiolar scale high, moderately thin, inclined forward, narrowed above, with rounded, entire, compressed superior border. Gaster elongate-elliptical. Legs rather stout.

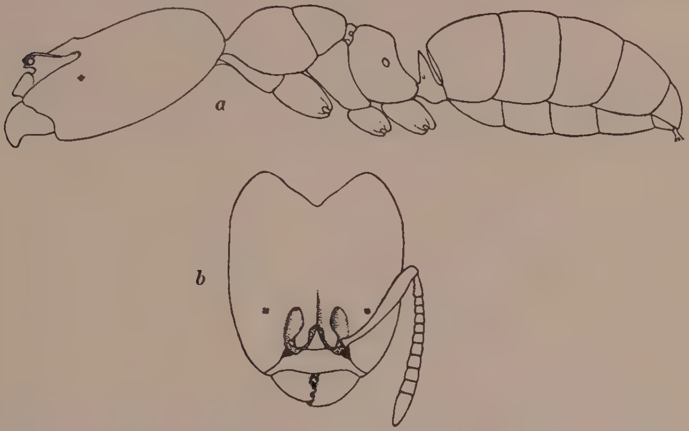


FIG. 3. *Pseudolasius* (*Nesolasius*) *typhlops* sp. nov. Soldier; *a,* in profile; *b,* head, dorsal view.

Mandibles, clypeus, thoracic dorsum and gaster shining, remainder of body subopaque, very finely shagreened, with fine piligerous punctures. Cheeks and antennal fossæ finely, longitudinally striate.

Hairs and pubescence pale yellow, the former long, erect and conspicuous on the gaster, shorter and much sparser on the head and thorax, long on the clypeus; hind tibiæ with a few long and oblique hairs on their extensor surfaces. Pubescence dense, especially on the head, thorax, scapes and legs, much more dilute on the gaster; appressed except on the thoracic dorsum.

Uniformly pale yellow, except the mandibles which are darker and more reddish, with black teeth.

A single specimen from Los Banos, Luzon Island, Philippines, taken by Dr. F. X. Williams in decaying wood.

The specimen is evidently a worker maxima. The anterior portion of its head is so unusual that it can hardly be assigned to Pseudolasius *sens. str.*, but whether Nesolasius will be regarded by other myrmecologists as an independent genus or as a subgenus of Pseudolasius may depend on the characters of the still unknown castes. Perhaps Forel's *Ps. amblyops* from the New Britain and his *sundaicus* from Sumatra should be assigned to Nesolasius. In the former the mandibles are 5-toothed and the eyes are reduced to a single facet. In *Ps. amaurops* Emery of New Guinea, which measures only 1.6-2 mm., the eyes are similarly reduced but the clypeus, frontal carinæ and 6-toothed mandibles show that it belongs to *Pseudolasius sens. str.*

A FEW NEW NORTH AMERICAN NEUROPTERA

By Nathan Banks

Museum of Comparative Zoölogy, Harvard University

In the course of determinations the following species have been detected and described as new.

Psammoleon arizonensis sp. nov.

In general similar to P. *sinuatus,* but smaller and separated by the marks of head, and the two dark marks on wings are not connected. In *P. sinuatus* the front edge of vertex is marked by a row of four distinct spots or scars, in this new species the median two scars are united into a large dark brown diamond-shaped mark; on the middle of vertex behind in *arizonensis* is a pair of small pale spots which in *sinuatus* are black spots united to the second vertex band. The pronotum shows, more or less plainly, the pale median line and two pale spots each side. The abdomen shows two pale above on each segment. The tarsi and claws are similar to P. *sinuatus.* The wings show the two oblique dark marks about as oblique as in *sinuatus,* but no connecting mark; the hind wings have a dark cloud on hind margin as in *P. sinuatus.*

Fore wings 26 mm. long, 5 mm. wide. Hind wings 24 mm. long, 4 mm. wide.

From Phoenix, 10, June; and Tucson, Arizona 25, July. (Streets collr.). Type M. C. Z. no. 20119.

Psammoleon decipiens sp. nov.

In general very similar to *P. guttipes.* Readily separated therefrom by the marks of the head. Above the interantennal mark is a transverse pale band above which is a velvety dark brown band from eye to eye, broader in middle, behind this on vertex another transverse pale band, and behind this another dark band (in *guttipes* the dark of interantennal mark extends up to the transverse row of four pale scars). The forewings have the usual two oblique dark streaks, the first concave toward base and before each of these marks there is a large area of wholly white venation, much larger than in *P. guttipes*. The venation is very similar to *P. guttipes* but in fore wings the costal area is less broad and the costal crossveins less numerous, so that the costal cells are not nearly as narrow as in *P. guttipes*.

Size as in *P. guttipes*. From Millin, Scriven Co., Georgia, and Shreveport, Louisiana. Type M. C. Z. no. 20118.

Psammoleon parallela sp. nov.

Face yellowish, a large black interantennal mark, vertex dark, two black lines across the ridges from eye to eye, last joint of labial palpi moderately dark, not greatly enlarged; antennæ annulate with brown; pronotum dark, a few faint pale marks, a rather large one each side; meso— and metanotum dark, a few pale spots or streaks, mostly through middle; pleura mostly pale, a few brown marks above, with long white hair; abdomen dull black, three pale spots above on each segment, a median one before middle, and one each side toward tip, with very short white hair above, longer below toward base. Legs pale, black spots on femora, mostly above, near base and tip of tibia, and some between, tips of tarsal joints black. Wings not very clear; veins pale, marked with black mostly in streaks, many cross-veins wholly dark, especially toward tip and behind, costals dark at each end; stigma yellowish, blackish basally; a dark streak obliquely up from end of anal and cubital fork, another oblique dark streak at rhegma, on several cross-veins; hind wings with veins mostly pale, and the dark not so black. Wings rather more narrow than usual, not widened near stigma, tip rounded; seven cross-veins before radial sector in fore wing, one in hind wing; ten branches to radial sector in fore wing, nine in hind wing; six cross-veins before cubital fork in fore wing, the anal runs nearly parallel to the cubital fork for a greater distance than in other species, and connected to each other by seven to nine cross-veins; in hind wing at most one cross-vein between cubital fork and first anal vein, often none.

Length of body, 20 mm. Length of forewing, 25 mm, width 5.2 mm. Length of hind wing, 25 mm., width 4.5 mm.

From Puerto Castillo, Honduras, (J. Bequaert); and Puntarenas, Costa Rica, 11-1907 P. Biolley, Philad. Acad. Nat. Science. Type M. C. Z. no. 20117.

Chrysopiella minora sp. nov.

Pale yellowish. Face with a brown stripe on each cheek down to the clypeus and there an inner extension; palpi marked with dark; no spot below bases of antennae, and no brown on lower sides of basal joints, but a stripe of brown on outer side of each basal joint, second joint dark brown, beyond the antennae are slightly dark. On front of vertex back of antennae is a fine curved dark line and on top of vertex two short dark stripes. Pronotum and rest of thorax unmarked, as well as legs. Wings with wholly pale venation, stigma more greenish. Wings very slender, more so than in other species, only eight radial cross-veins, only three or four in outer gradate series, the last of these not its length from margin, third cubital cell long, the divisory vein starting from middle of base of cell and ending beyond the end of the cross-vein above; twelve to thirteen costals before stigma.

Length of forewing 8mm., width 2.7 mm.

Umatilla, Oregon, 24 June, 1882 (S. Henshaw). Smaller and lacks dark marks of the face of other species. Type M. C. Z. 19439.

Boriomyia furcata sp. nov.

In my table (Psyche 1930, 224) runs to 11, but smaller than either and with quite different male genitalia. Face shining brown; basal joints of antennae dark, beyond pale, scarcely annulate; vertex dark, with a median darker line; pronotum with broad dark side margins and narrow median line, rest of thorax mostly dark but with sutures pale; legs pale, base and tips of front and mid tibiæ dark; abdomen dark above, pale below, above with erect pale yellowish hair, most prominent near tip. Forewings rather heavily marked with brown, tending to form many bands, more distinct over the first gradate series; veins dotted and spotted with dark and white.

Wings of moderate length and breadth; cross-vein between first radial sector and median vein is beyond fork of median, no cross-vein between first and second radial sectors near their bases, one between last radial sector and radius, that between median and cubitus is longer than that between cubitus and its fork; the first gradate series (of 6 or 7) form a nearly even series across, but very little disjointed, and less oblique than in related species. The male appendages are deeply forked.

Length forewing 8 mm., width 3 mm.

From Argentine Pass, Colo. (Cockerell). Type M. C. Z. 19436.

Allotomyia borealis sp. nov.

Pale yellowish; in the male the face is shining black, in the female with a transverse spot below antennae; pronotum dark on sides; mesonotum and metanotum dark above base of wings; abdomen brown; forewings marked with dark at the gradate series, and some spots toward base, and with marginal brown spaces alternating with white spaces; many of the veins with dark dots; hind wings wholly pale, without marks. Venation much as in *A. fidelis;* no cross-vein from last radial sector to radius, one from first radial sector to second near its base, and a little before the cross-vein from the first radial sector to the median vein; first series of gradates further out than in *A. fidelis,* as near to second series at these to the outer margin. Male genitalia very different from *A. fidelis;* seen from the side extremely broad toward base.

Length of forewing 8 mm.

A male from Hillsboro, N. H., 12 June. A female taken by Mrs. Slosson many years ago at Franconia, N. H. agrees in the markings of the wings. Type M. C. Z. 19437.

Megalomus uniformis sp. nov.

Body, antennae, and legs pale yellowish, unmarked; wings the same, but the gradate series are narrowly brown, and a dot on the connection of cubitus and median, and faint brown borders of apical forkings; the dark dots seen on the veins of other species are here practically absent; hind wings slightly embrowned around margin. Costal area very broad at base, broader than in *M. moestus*, about as broad as *M. latus*, some of the costal veinlets toward base are forked twice; four cross-veins between the sub-costa and radius, one at base, two between the second and third radial sectors, and one near the stigma; seven radial sectors; first series of gradates further out than in other species, evenly oblique (not broken) and formed of thirteen cross-veins before it ends in a hyaline spot at hind margin; outer gradate series of ten cross veins, forming only a slight curve, and nearer to the first row than in allied species.

Length of forewing 7 mm.

From Brownsville, Tex. (Snow coll.) Type M. C. Z. 19438.

VARIETAL FORMS OF PERIPATUS IN HAITI.

By Charles T. Brues

Biological Laboratories, Harvard University

During the past year Dr. P. J. Darlington of the Museum of Comparative Zoölogy spent some time in the Republic of Haiti where he obtained extensive collections of insects and other arthropods. Among this material are four lots of Onychophora taken at separated localities, including altogether 23 specimens. Previous to this there seem to have been discovered in Haiti only two specimens of Onychophora. These were contained in collections made by Dr. William M. Mann in 1912 and were dealt with by the writer in a previous paper.[1]

On account of striking differences in color and in the form of the integumentary papillæ, I considered Mann's specimens to represent two species, one of these I regarded as a subspecies of *P. dominicæ* Pollard of which the typical form inhabits the Island of Dominica while two other varieties occur on Antigua and Porto Rico respectively. The other form was named *P. manni* after its discoverer.

A close examination of the material obtained by Dr. Darlington discloses the fact that there are other forms of Peripatus in Haiti which appear to be clearly distinguishable from one another and furthermore that these appear to occupy separated regions or different ecological situations. I find also that he has rediscovered the two forms taken by Mann in the vicinity of the type locality near Furcy.

In order to present more clearly the differential characters of these several very similar forms, the following table has been constructed. It will be seen that the characters used are quite probably of different value, at least in our present state of knowledge. The form and arrangement of

---

[1] Preliminary Descriptions of two new Forms of Peripatus from Haiti. Bull. Mus. Comp. Zool., Harvard, vol. 54, pp. 519-521 (1913).

the papillæ are subject to some individual variation, but on the whole seem to be reasonably constant. Variations in the form and attachment of the nephridial tubercles are also subject to but slight variation. On the other hand, such characters as the dentition of the mandibles and the number of leg-bearing segments are subject to sufficient variation to render them of lesser importance in the absence of other more distinctive characters. Nevertheless it seems that the characters used in the table are sufficient to indicate clearly that the several forms are racially distinct. This conclusion is borne out by very striking differences in the insect fauna of the several areas which have been observed by Dr. Darlington. The three moist mountain ranges from which the Peripatus come are separated by low, dry, highly xerophytic areas into which such animals are utterly unable to penetrate, and it is certain that no migration has occurred since such conditions became established. The failure of certain genera of flightless Carabidæ to bridge these gaps is clear evidence that these mountains are actually isolated after the fashion of true islands. In this respect Haiti is quite different from the other West Indian Islands on which Peripatus is known to occur since it affords clearly isolated mountain ranges. So far none have been discovered in Cuba, but two very distinct types are known from Jamaica, both inhabiting the extensive and continuous Blue Mountain Region in the eastern part of the Island. These appear to be very local in occurrence, and commonly associated at the same places. One, *P. juliformis*, var. *swainsonæ* Ckll. is a true Peripatus, but the second which occurs with it is a modified type now relegated to the genus Plicatoperipatus. The occurrence of Onychophora in Jamaica is, however, so far as known, restricted to the Blue Mountains as none have been discovered in other parts of the island.

I have hesitated to propose any new taxonomic names, but as the material seems to justify some recognition of the five more or less readily distinguishable forms known from Haiti, those not already named are regarded as varietal forms. In general body color all are essentially similar, very dark in life, but after preservation in alcohol showing a very dark, beaded dorsal stripe the enlargements of which correspond to the body segments. Just lateral to the stripe is a narrow pale border which serves to render it quite conspicuous, especially in some specimens. The nephridial tubercles are practically of the same conformation in all of the forms. They are attached slightly or free from the third band which is emarginate and the fourth band is bent, but scarcely emarginate next to the tubercle.

Key to the Forms of Peripatus known from Haiti

1. Some of the primary papillæ on the integumentary folds clearly much larger than the remainder and arranged in such a way that one or several smaller ones are regularly interpolated between two large ones ....2.
   Primary papillæ variable in size but not showing a definite arrangement on the folds with regard to size, *i. e.*, the largest papillæ are not regularly spaced with reference to intervening smaller ones; very few or almost no accessory papillæ ....4.
2. A number of accessory papillæ present along the sides of the body folds ....3.
   Accessory papillæ very few in number, almost absent; 30-33 pairs of legs in the female; blade of mandible with 14 teeth ....*Peripatus dominicæ* Pollard, var. *lachauxensis*, var. nov.
3. A bright orange spot at each side of the head (sometimes white in specimens that have been bleached by preservation in alcohol); mandible with 11-12 teeth; 30-31 pairs of legs in the female ....*Peripatus manni* Brues.
   No pale markings of this kind present; body uniformly dark above, except for the shaded, dorsal pattern; blade of mandible with 8-10 teeth; 30-32 pairs of legs in the female ....*Peripatus dominicæ* Pollard, var. *haitiensis* Brues.
4. 28 pairs of legs in the female; mandible with 11 teeth ..... *Peripatus dominicæ* Pollard, var. *basilensis*, var. nov.
   33-34 pairs of legs in the female; mandible with 9 teeth. *Peripatus dominicæ* Pollard, var. *darlingtoni*, var. nov.

Peripatus manni Brues.

Bull. Mus. Comp. Zoöl., vol. 54, p. 520 (1913).

Six females and one male from near La Vesite, La Selle Plateau, Haiti (5,000-7,000 ft.), September 16-23, 1934 (P. J. Darlington). These are practically from the type locality which is near Furcy that lies just to the north of Vesite, and they were taken at practically the same altitude. The females have from 30-31 pairs of legs, two with the former and three with the latter number. The single male has 29 pairs. The conspicuous pale spot at the side of the head is present in both sexes.

Peripatus dominicæ Pollard, var. **haitiensis** Brues.

Bull. Mus. Comp. Zoöl., vol. 54, p. 519 (1913).

Of this form Dr. Darlington secured eight females and two males at the same place as the previous species, which is again practically the type locality. The occurrence of the two thus together suggests of course that they may be only color forms of one another although no such condition has been found to prevail elsewhere in the group which now includes about one hundred species. Among the American forms only *Peripatus torquatus* has a color pattern similar to that of *P. manni;* in this case the spots are almost united to form a transverse yellow band behind the head, and appear to be a constant specific character. Morphological differences are slight, as indicated in the key, and the general arrangement of the of the integumentary papillæ is much the same although there are fewer accessory papillæ in *haitiensis.*

Peripatus dominicæ Pollard, var. **lachauxensis,** var. nov.

This form is represented by two specimens from Etang Lachaux, taken October 27, 1934 by Dr. Darlington at an altitude of less than 1,000 ft. This locality is in the southeastern foot-hills of the Massif de la Hotte in the southeastern peninsula of Haiti. It is much nearer to sea-level than any of the others and is consequently much drier. As indicated in the key this variety differs from the preceding forms by the almost complete absence of accessory papilllæ on the body folds and an unusually large number of small teeth on the blade of the mandible.

This is based on a single female from Mount Basil in northern Haiti taken at an altitude of about 4,000 feet on September 9, 1934 by Dr. Darlington.

Peripatus dominicæ Pollard, var. **basilensis,** var. nov.

This specimen has only 28 pairs of legs and a single large embryo which we have been able to remove by dissection shows the same number. The sex of the embryo cannot be determined and may of course be male, but the female shows that this form has an unusually small number of legs. As indicated in the key this variety is distinguishable from the preceding forms by the arrangement of the primary integumentary papillæ.

Peripatus dominicæ Pollard, var. **darlingtoni,** var. nov.

This is represented by two females and one male from Massif de la Hotte in the southwestern peninsula of Haiti taken between Camp Perrion and Mafin at an elevation of about 3,000 feet. The locality is near that where the variety *lachauxensis* was taken, but at a higher altitude and consequently in the moist rain forest belt. It differs from that form by the arrangement of the primary papillæ as set forth in the preceding key and from the variety *basilensis* which it resembles more closely by the greater number of legs in the female.

A NEW HESPERID FROM HAITI (LEPIDOPTERA; RHOPALOCERA)

By E. L. Bell
Flushing, New York

Poanes batesi new species

Male. Upper side. Primaries with a conspicuous, oblique, narrow greyish stigma of two parts broadly bordered with black on each side, the upper part, slightly curved, extends from near the base of vein 3 to vein 2; the lower part is continued obliquely inward from vein 2 to about the basal third of vein 1. The costal margin to near the end of the cell and the cell itself are orange fulvous. Basal area of cell 1 orange fulvous, somewhat darker. Outer half of wing blackish brown, well sprinkled with orange fulvous scales. Three subapical orange fulvous spots in interspaces 6, 7 and 8. A triangular, semi-hyaline, pale orange fulvous spot in the base of interspace 3; a larger, irregular semi-hyaline spot of similar color lies outside the upper part of the stigma in interspace 2; in interspace 1 a prominent, though not sharply defined, narrow orange fulvous streak extends along vein 1 from the base of the stigma to under the semi-hyaline spot in interspace 2. Below vein 1 the inner margin is orange fulvous from the base nearly to the inner angle of the wing. Fringes blackish at the base, paler brown at the tip, except at the inner angle where they are orange fulvous.

Secondaries. Costal area above vein 7, abdominal fold and a narrow outer border are black, the rest of the wing orange fulvous, through which some of the black veins feebly show, at the end and along the lower edge of the cell more distinctly than the rest. Fringes orange fulvous with blackish scales at the base and which intermix with the orange fulvous at about the center of the wing border.

Under side. Primaries with the basal area, except at the costal margin, black, at the costal margin the base is bright green. A narrow black streak corresponds to the upper part of the stigma, and the end of the cell is narrowly black. The costal margin from the bright green base to beyond the end of the cell, the cell itself, an area enclosing the two semi-hyaline spots of the upper side, are orange fulvous, from here a broad, irregular brown band extends to the margin of the wing. The entire apical area is heavily overscaled with bright green, through which the three subapical spots sometimes indistinctly show. The two semi-hyaline spots of the upper side are repeated but as they lie in an orange fulvous area they are less distinct than on the upper side. The streak in interspace 1 is larger than on the upper side and much paler in color. Below vein 1 the wing is brown. Fringes at the inner angle orange fulvous, above there brown to the apex, with whitish scales sparsely intermixed at the base, forming a basal line, which varies in distinctness with individuals, and may be entirely lost in very worn specimens.

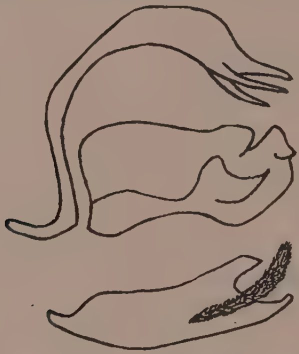


FIG. 1. *Poanes batesi* new species, male genitalia.

Secondaries. The ground color is dark brown, heavily overscaled with bright green, except the abdominal fold which remains brown bordered on each side with orange fulvous scales. The green overscaling does not quite reach the outer margin of the wing and thus leaves a narrow marginal line of the dark brown ground color. A discal band of black spots, usually three, as follows: one, squarish or roundish, between veins 2 and 3, a small one above it between veins 3 and 4, and another small one between veins 6 and 7, which is sometimes absent, and in occasional individuals there is a fourth spot between veins 7 and 8. Fringes orange fulvous at the anal angle, above there brown at the base and orange fulvous at the tip; the white basal line more distinct than on the primaries.

Body above: thorax blackish; abdomen heavily haired with fulvous and greenish in the basal half, tip of anal tuft orange fulvous. Tegulæ and shoulder covers green. Head and collar green, sometimes with orange fulvous hairs intermixed. Eyes black. Antennæ black.

Body beneath: thorax and abdomen green and orange fulvous. Palpi and pectus green and orange fulvous. Antennæ spotted with yellowish between the joints, the club orange fulvous, apiculus reddish. Legs brownish with fulvous hairs.

Female. Upperside. Primaries dark brown, the basal area and below vein 1 overscaled with dark orange fulvous, the rest of the wing, except the end of the cell, more or less sprinkled with scales of the same color. A narrow orange fulvous streak near the base of the cell on the lower edge and sometimes another, less distinct, above it; both of these in some individuals are either absent or very indistinct. Two semi-hyaline spots in the apical third of the cell, one above the other and sometimes coalescent. Three semi-hyaline subapical spots in an oblique line in interspaces 6, 7 and 8, sometimes the middle one is a little inward of the other two. A semi-hyaline spot in each of interspaces 2 and 3 and an orange fulvous streak in interspace 1 similar to those of the male. All of the semi-hyaline spots mentioned above are tinted with pale orange fulvous. Fringes orange fulvous at the inner angle, above dark brown and orange fulvous intermixed.

Secondaries. Similar to those of the male but a little darker in tone.

Beneath. Primaries dark brown, except the costal margin which is green at the base and orange fulvous from there to the end of the cell and an orange fulvous spot in the end of the cell in which lies the two semi-hyaline spots of the upper side. The apical area is heavily overscaled with green, the three subapical spots edged with white. The semi-hyaline spots in interspaces 2 and 3 are repeated and the streak in interspace 1 is much larger and paler than on the upper side. Fringes orange fulvous at the inner angle, above brown with orange fulvous tips, the white basal line often more distinct than in the male.

Secondaries. Similar in color to the male but instead of the discal band of black spots in that sex there is an irregular discal band of five silvery white spots, bordered outwardly with the dark brown ground color. The band of spots is composed of two sections, the lower part of three spots as follows: one below vein 2, one between veins 2 and 3 and one between veins 3 and 4, these are in a slightly curved line and the middle one is usually the larger. The upper section of the band consists of two spots, one between veins 6 and 7 and the other, usually the smaller, between veins 7 and 8. Fringes orange fulvous at the anal angle, above there brown, orange fulvous at the tip. The white basal line is very prominent.

The body and all appendages are similar in color to those of the male.

Expanse: male 32 - 34 mm.; female 32 - 36 mm.

Described from 15 males and 6 females collected by D. Marston Bates and P. J. Darlington on the La Selle Range, Haiti, during the latter part of September, 1934, and one female collected by Darlington near Mt. Hotte, Haiti, October 13, 1934.

Holotype male, La Selle Mts., September 23. Allotype female, La Selle Mts., September 20. Paratypes: 14 males, 5 females, La Selle Mts., September 18-23; 1 female, Roche Croix, La Hotte, October 13. The type, allotype, and 16 paratypes are in the collection of the Museum of Comparative Zoology, Cambridge, Mass., M. C. Z. 20141; 4 paratypes (2 males, 2 females) are in the collection of the author.

It is with pleasure that this beautiful species is named for one of its discoverers, Dr. D. Marston Bates, of the Museum of Comparative Zoology.

The mid tibiæ of *batesi* are feebly spined and this character together with the linear stigma and genitalic characters of the male seem to best ally this insect with those species contained in the genus *Poanes*, where it would fall in the group comprising the former genus *Paratrytone* Dyar which was united with *Poanes* by Lindsey (University of Iowa Studies, ix, (4), pp. 84, 85, 1921). This section of the genus is represented in the North American fauna by *aaroni* Skinner and *yehl* Skinner, and in Mexico by *rhexenor* Godman, *polyclea* Godman, *aphractoia* Dyar and of these *batesi* is most nearly allied to the last four mentioned but is easily distinguished from them by the characters given in the above description, the green overscaling of the underside of the wings will alone separate it from any of the others. In addition, to date, none of the other species mentioned have been found in Haiti, the habitat of *batesi.*

Professor Nathan Banks in forwarding the specimens of *batesi* to the writer supplied the following important and interesting information concerning the region from which they came; he writes that the specimens from the La Selle Mountains were collected on the plateau of that range between 6,000 and 7,400 feet elevation, mostly in open pine woods or along the edge of cloud-forest in the vicinity of the peaks known as Cayes Jacques and La Vesita. The single female taken by Dr. Darlington near Mt. Hotte was found at an elevation of about 5,000 feet and the locality is about one hundred miles from where the other specimens were taken, with much low country between.

Batesi appears to be a species of the high altitudes and in this respect agrees with the Mexican species *polyclea* Godman and *aphractoia* Dyar, the type of the first mentioned said to have come from 8,000 feet elevation and that of the second from 13,000 feet elevation. The North American *yehl* seems to be a species of the low coastal areas although it does extend into Tennessee, but there are no altitude records available to the writer for that part of its habitat.

The figure of the male genitalia is taken from one of the paratypes from the La Selle Mountains.

MYRMECOLOGICAL NOTES

By William Morton Wheeler
Biological Laboratories, Harvard University

1. New Subgenera of Dolichoderinæ.

The genus Dolichoderus Lund (1831) now comprises more than 150 described species, subspecies and varieties. While revising these forms I have found it advisable to add to the number of subgenera recognized by Emery in his already somewhat antiquated fascicle on the Dolichoderinæ in the "Genera Insectorum" (1912). He accepted only three genera, Dolichoderus *sens. str.*, Monacis Roger (1862) and Hypoclinea Mayr (1855). The first and second restricted to tropical America, contain comparatively few species and are clearly defined. All the remainder were assigned to Hypoclinea, which is very heterogeneous and much more widely distributed, since it is represented in all the great zoögeographical regions, except Africa and Oceania. More recently (1926) Karawajew has established another subgenus, Diabolus, on what he erroneously supposed to be an undescribed species from Java. I adopt this subgenus, however, and propose three others for as many groups of East Indian, Papuan and Australian species formerly assigned to Hypoclinea. These subgenera, which are here listed are characterized like Dolichoderus *sens. str.* and Monacis, by peculiarities of the thoracic armature:

Monoceratoclinea subgen. nov. Subgenotype: *Dolichoderus* (*Hypoclinea*) *monoceros* Emery (1897). Other species: *D.* (*H.*) *tricornis* Emery.

Habitat: New Guinea.

Diabolus Karawajew (1925). Subgenotype: *Polyrchachis cuspidatus* F. Smith (1857) (This subgenus was based on *D.* (*Diabolus*) *bifurcatus* Karawajew, which is synonymous with *D.* (*H.*) *cuspidatus surbecki* Santschi (1925). Other species: *furcifer* Emery and *coniger* Mayr.

Habitat: Indonesia.

Diceratoclinea subgen. nov. Subgenotype: *Dolichoderus scabridus* Roger (1826). Other species: *beccarii* Emery, *angusticornis* Clark, *indrapurensis* Forel, *ypsilon* Forel.

Habitat: Australia and Indonesia.

D. cornutus Mayr of the Baltic Amber also belongs to this subgenus.

Acanthoclinea subgen. nov. Subgenotype: *Dolichoderus doriæ* Emery (1887). Other species: *edentata* Forel, *extensispinosa* Forel and *clarki* nom. nov. for *D. tristis* Clark (1930) *nec. D.* (*Monacis*) *tristis* Mann (1916).

Habitat: Australia.

Unfortunately, these subgenera only slightly reduce the number of species in Hypoclinea. We may follow Emery in distinguishing four geographical groups in this subgenus, a holarctic (to which the name Hypoclinea properly belongs, since the Eurasian *quadripunctatus* L. is the subgenotype) a Neotropical, an Indomalayan and an Australian, but I have not been able to discover in the workers any characters that would justify further subgeneric division. This may be possible when the sexual phases are better known. That the females may possess characters of taxonomic value is suggested by Acanthoclinea. Though colonies of this subgenus are not uncommon in Eastern Australia, no one has ever seen a winged female of any of the species. Very recently, however, Clark (Mem. Nat. Mus. Melbourne No. 8, 1934, p. 40, pl. 3, fig. 6) has described and figured a peculiar ergatoid female from a colony of *doriæ.* It is not improbable, therefore, that this is the typical and only form of female in the subgenus as it is in Leptomyrmex and several other Australian ant-genera.

2. The Tribe of Melophorini Forel.

According to Emery, (Gener. Insect. 1927), this the most primitive tribe of Formicine ants comprises only two genera, Melophorus Lubbock and Notoncus Emery, but it needs revision both by subdivision of the old genus Melophorus and by addition of two other genera. One of these is Myrmecorhynchus for which I made a special tribe in 1917. In this I was followed by Emery, but I am now convinced that Mrymecorhynchus is a Melophorine. Clark has recently added another genus, Pseudonotoncus, which is related to Notoncus. I find that specimens of the type, *Ps. hirsutus* Clark, which long awaited description in my collection, have a typical Melophorine gizzard. *Diodontolepis,* a genus, which I based on *Melophorus spinisquamis* Ern. André in 1922, was again merged with Melophorous by Emery in 1927, but this was a blunder, as any myrmecologist who has seen specimens of the insect will admit. According to Clark, its habits too, differ from those of Melophorus.

The old genus Melophorus was divided by Emery into three subgenera: Melophorus *sens. str.*, Prolasius Forel and Lasiophanes Emery. In this he followed Forel (1911) who had declined to split the genus though he was impressed by the heterogeneity of the species, some of which he characterized as Cataglyphis-like, others as Pheidole-like and still others as Formica- and Lasius-like. I believe that Prolasius and Lasiophanes which have monomorphic lasiiform or formiciform workers should be regarded as distinct though very closely related genera of Antarctic origin. Up till 1934 only one species had been assigned to Prolasius, namely *P. advena* of New Zealand, but I found in 1931 that several of the Australian species placed by Forel and Emery in Melophorus clearly belong to Prolasius, and Clark has very recently described several others. The true Melophori, thus restricted to species with polymorphic workers, may be divided into three subgenera mainly on thoracic structure, namely Melophorus *sens. str.* comprising the Cataglyphis-like forms, Erimelophorus subgen. nov. the Pheidole-like forms with huge-headed maxima workers, and Trichomelophorus subgen. nov. for *M. hirsutus* Forel and its varieties. This subgenus is characterized also by peculiar sculpture and very long dense pilosity. The following therefore represents my conception of the generic and subgeneric composition of the tribe Melophorini:

Genus *Lasiophanes* Emery (1895).

Genotype: *Formica nigriventris* Spinola (1851). Other species: *bruchi* Forel, *bolivari* Santschi, *hoffmanni* Forel, *perplexus* Santschi, *picinus* Roger, *sauteri* Forel, *uxorius* Emery, *valdiviensis* Forel, *edwardsi* Donisthorpe, *negrensis* Donisthorpe, *rufoniger* Donisthorpe.

Habitat: Patagonia, Argentina, Chile.

Genus *Prolasius* Forel (1892).

Genotype: *Formica advena* F. Smith (1862) of New Zealand. Australian species: *depressiceps* Emery, *formicoides* Forel, *mjöbergiellus* Santschi, *nitidissimus* Ern. André, *scipio* Forel, *abruptus* Clark, *pallidus* Clark, *hemiflavus* Clark, *niger* Clark, *flavicornis* Clark, *hickmani* Clark, *rotundiceps* Clark.

Genus *Melophorus* Lubbock (1883).

Habitat: Australia.

Melophorus (subgen. emend.). Subgenotype: *M. bagoti* Lubbock (1883). Other species: *aeneovirens* Lowne, *curtus* Forel, *constans* Santschi, *iridescens* Emery, *insularis* Wheeler.

Erimelophorus subgen. nov. Subgenotype: *M. wheeleri* Forel (1910). Other species: *biroi* Forel, *fieldi* Forel, *marius* Forel, *mjöbergi* Forel, *omniparens* Forel, *pillipes* Santschi, *laticeps* Wheeler, *turneri* Forel.

Trichomelophorus subgen. nov. Subgenotype: *M. hirsutus* Forel (1902).

Genus *Diodontolepis* Wheeler (1922).

Genotype: *Melophorus spinisquamis* Ern. André (1896).

Habitat: Eastern Australia.

Genus *Pseudonotoncus* Clark (1934).

Genotype: *Ps. hirsutus* Clark (1934).

Habitat: Southeastern Australia.

Genus *Notoncus* Emery (1895).

Genotype: *Notoncus ectatommoides* Forel (1892). Other species: *capitatus* Forel, *enormis* Szabó, *foreli* Ern. André, *gilberti* Forel, *mjöbergi* Forel, *politus* Viehmeyer.

Habitat: Australia.

Genus *Myrmecorhynchus* Ern. André (1896).

Genotype: *M. emeryi* Ern. André (1896). Other species: *carteri* Clark, *musgravei* Clark, *nitidus* Clark, *rufithorax* Clark.

Habitat: Eastern Australia.

3. SOME PREOCCUPIED NAMES.

In addition to Karawajew's and Clark's homonyms cited above, I would call attention to the following, which I have discovered in my own writings on other genera :—

Acropyga (*Rhizomyrna*) *indosinenis* nom. nov. for *A.* (*R.*) *silvestri* Wheeler (1927) *nec. A.* (*Malacomyrma*) *silvestri* Emery (1915).

Nylanderia consuta nom. nov. for *N. dicroa* Wheeler (1934). *nec. N. dichroa* Karawajew (1933).

Camponotus (*Myrmocladoecus*) *sanctae-fidei weberi* nom. *nov. for C.* (*M.*) *sanctae-fidei darlingtoni* (Nov. 1934). *nec. C.* (*Myrmophyma*) *darlingtoni* Wheeler (Oct. 1934).

Ponera leæ norfolkensis nom. nov. for *P. leae oculata* Wheeler (1927) *nec Ponera oculata* F. Smith (1858).

PIN-LABELS IN MULTIPLES OF 1000, ALIKE

One Dollar Per Thousand

Smallest Type. Pure White Ledger Paper. Not over 4 Lines nor 30 Characters (13 to a line) Additional Characters, 3 cents each, in total and per line, per 1000. Trimmed so one cut makes a label.

C. V. BLACKBURN, 7 Emerson St., STONEHAM 80, MASS

CAMBRIDGE ENTOMOLOGICAL CLUB

A regular meeting of the Club is held on the second Tuesday of each month (July, August and September excepted) at 7.45 p. m. in Room B-455, Biological Institute of Harvard University, Divinity Ave., Cambridge. Entomologists visiting Boston are cordially invited to attend.

WARD'S ENTOMOLOGICAL SERVICES

Entomological Supplies and Equipment

Carefully designed by professional entomologists. Material of high quality at low prices. Send for Supply Catalog No. 348.

Insect Preparations

Life Histories, Type Collections, Collections of Economic Insects and Biological Insect Collections. All specimens are accurately determined.

Insects for the Pest Collection

We have in stock over three hundred species of North American Insect Pests. Send for Price List No. 349.

Ward's Entomological Bulletin

A monthy publication sent free to all entomologists requesting it.

Information for the Beginner

Send for "Directions for Collecting and Preserving Insects" by Dr. A. B. Klots. A mine of useful information. Price 15 cents.

WARD'S NATURAL SCIENCE ESTABLISHMENT, Inc.
P. O. Box 24, Beechwood Station
Rochester, N. Y., U. S. A.
The Frank A. Ward Foundation of Natural Science of the University of Rochester

COMPLETE SET OF PSYCHE

Volumes 1-38 (Bound) For Sale

Please communicate with Richard Dow, Boston Society of Natural History, 234 Berkeley St., Boston, Mass. This is the set belonging to the late Mr. C. W. Johnson. Other books and periodicals from Mr. Johnson's library are also for sale.

BACK VOLUMES OF PSYCHE

The Cambridge Entomological Club is able to offer for sale the following volumes of Psyche. Those not mentioned are entirely out of print.

Volumes 2, 3, 4, 5, 6, 7, 8, 9, 10; each covering a period of three years, $5.00 each.

Volumes 12, 14, 15, 17, each covering a single year, $1.00 each.

Volumes 18, 19, 20, 21, 22, 23, 24, 25, 26, each covering a single year, $1.50 each.

Volumes 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, each covering a single year, $2.00.

Orders for 2 or more volumes are subject to a discount of 10%.

Orders for 10 or more volumes subject to a discount of 20%.

A set of all the volumes available (36 in all) will be sold for $71.00.

All orders should be addressed to

F. M. CARPENTER, Associate Editor of Psyche,
Museum of Comparative Zoölogy,
Department of Entomology,
Cambridge, Mass.